ELECTRONICS Australia

HIFI NEWS

AUGUST, 1975
AUST 80c* NZ 80c

ROBOTS: JUST WHAT DOES THE FUTURE HOLD?

FM TUNER FRONT END * FREQUENCY SHIFTER FOR PA * TRANSISTOR ASSISTED IGNITION

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VOLUME 37 No 5

The near future holds the promise of manufacturing industries based on integrated systems of robots and automatic machinery. Our article on page 30 takes a look at the status of robots today, and examines their potential for tomorrow.

Equivalent to the well known KEF "Concerto," this high quality loudspeaker system is intended for the more discerning Hi-Fi enthusiast. Full constructional details commence on page 48.

On the cover

Sensor Station 3 in the RAAFs new P3C Orion aircraft handles the non-acoustic sensors such as radar, low light level TV, magnetic anomaly detector, and submarine anomaly detector. The Government's decision to buy eight P3C Orion long range maritime patrol aircraft from Lockheed will result in offset contracts worth about $25 million to the Australian electronics industry. (Photograph courtesy Lockheed Australia).

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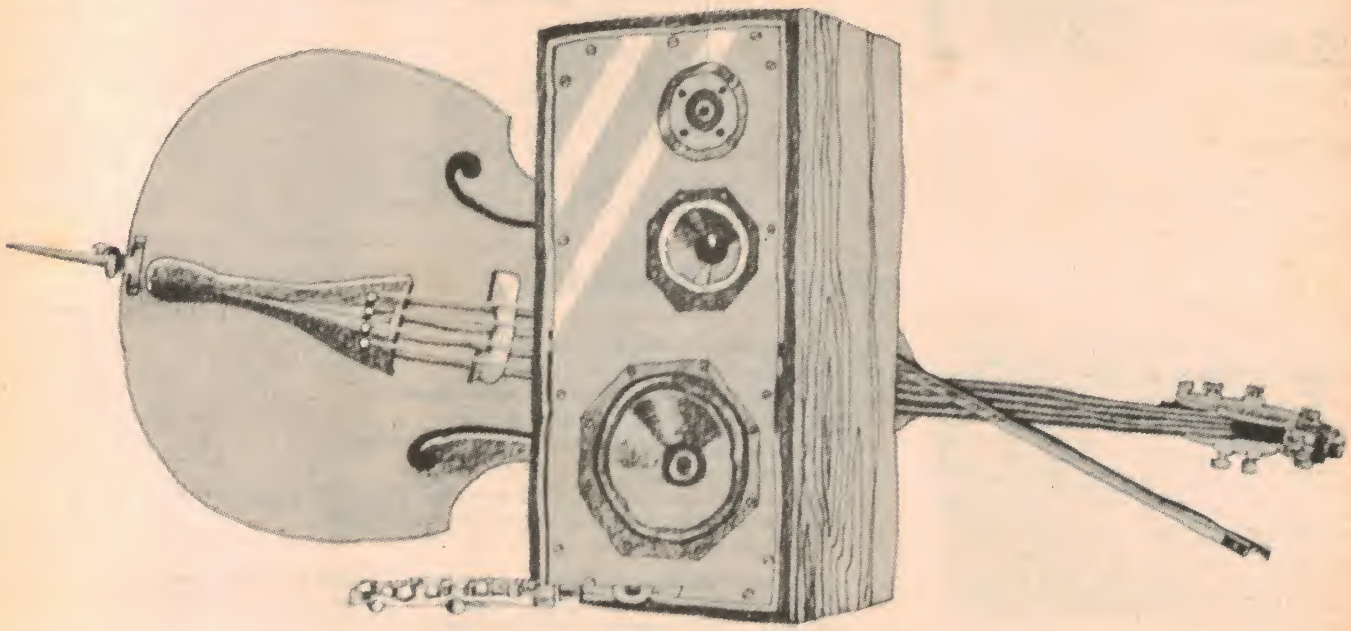
world of electronics and hi-fi

projects and technical

regular features

PHILIPS

How can you afford a really good speaker system that has minimal distortion?



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ELCOMA

153·64

Editorial Viewpoint

Community radio & TV stations

It was interesting to note the speed with which the experimental "ethnic" radio community station 2EA was set up a few weeks ago in Ashfield, NSW, as we report in the news columns on page 27. The station was commissioned less than 2 weeks after receiving the order from the Australian Government—surely an all-time record.

The really noteworthy thing about the speedy birth of the station is that it just wouldn't have been possible without the hard work and willing co-operation of a number of people, firms and organisations.

People like Clare Dunne, the well-known Irish actress, and Al Grassby, the Government's special advisor on community affairs, who have both taken an active personal role in addition to their official functions of administration and co-ordination.

Firms like AWA, who set up the 500-watt transmitter and front-lawn aerial towers at their Ashfield factory in double-quick time.

And organisations like the Christian Broadcasting Association, who are providing the studio and recording facilities of the station at their Five Dock centre, under their Director Rev. Vernon Turner.

It seems to me particularly appropriate that this sort of co-operation has been associated with the setting-up of one of our first community radio stations. I hope it augurs well for the developing role of such stations in generating and boosting community spirit—a scarce and frail commodity in modern urban life.

Spurred on by the success of station 2EA, I hope Mr Grassby and the Australian Government will give further thought to the setting up of more community stations, both radio and television. Not just ethnic and special-interest stations of the type explored to date, but also broad-function stations designed to provide an effective focus for community activity in outer urban and rural growth centres.

The contribution such stations could make to the growth and support of real community feeling and involvement, not only in growth areas but in established suburbs and towns as well, would surely be a very rich return on the relatively modest investment required.

Let us hope, then, that station 2EA is but the first of many community media centres—in more ways than one.

—Jamieson Rowe

EDITOR-IN-CHIEF
Neville Williams
M.I.R.E.E. (Aust.) (VK2XV)

EDITOR
Jamieson Rowe
B.A. (Sydney), B.Sc. (Technology, NSW)
M.I.R.E.E. (Aust) (VK2ZLO/T)

ASSISTANT EDITOR
Philip Watson
A.M.I.R.E.E. (Aust.) (VK2ZPW)

SCIENCE FEATURES
Greg Swain, B.Sc. (Hons, Sydney)

PRODUCT REVIEWS
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Ian Pogson (VK2AZN/T)

GRAPHICS
Robert Flynn

PRODUCTION
Ross Tester

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

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12th Floor, 235 — 243 Jones Street, Broadway, Sydney, 2007. Phone 2 0944. Postal Address: PO Box 163, Beaconsfield 2014.

Advertising Offices
Sydney — 57-59 Regent St, Sydney 2008. Phone: 699 3622.
Representative: Noel Fitzpatrick
Melbourne — 425 St Kilda Road, Melbourne, 3004. Phone: 267 3800.
Representative: Keith Watts
Adelaide — Charles F. Brown & Associates Ltd, 168 Melbourne St., North Adelaide 5006
Representative: Tom Duffy 267 4377
Perth — 454 Murray Street, Perth 6000.
Representative: Jack Hansen. 21 8217

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Guess who just improved on BASF LH Tape?

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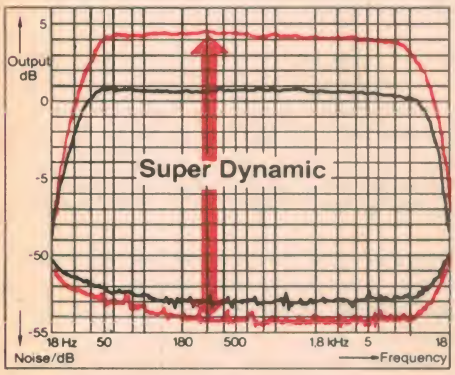

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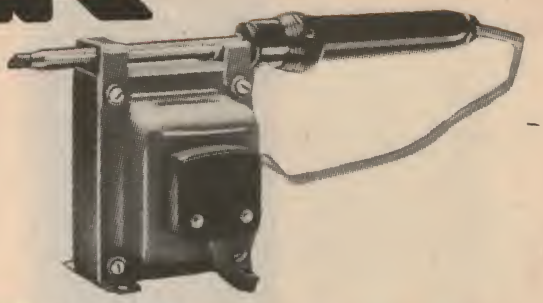
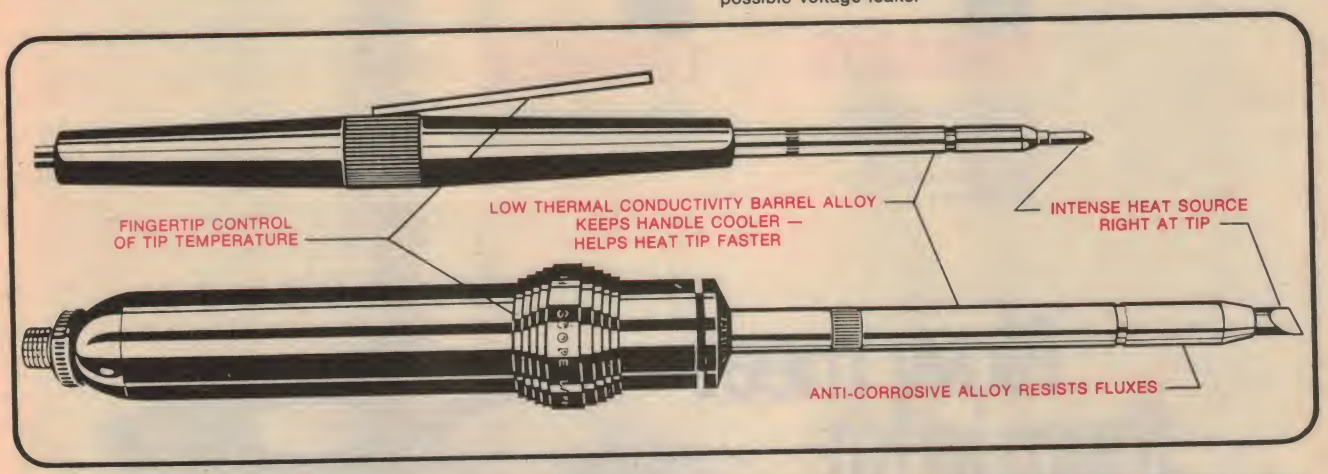


SCOPE TRANSFORMER
This transformer is specially designed to provide a safe low voltage power source for Scope Superspeed irons (and Vibroscope etching tools).
An earthed isolation shield prevents capacitive coupling with possible voltage leaks.



1. **Provide intense heating power:**
The patented heating concept located right behind the tip provides tremendous heat output to get the iron hot fast; then keeps the temperature under your control to complete every joint faster.

2. **Let you control the power:**
Should you encounter a heat sink which would rapidly drain away tip heat (e.g. thick metal or a need for plenty of molten solder) your finger switch provides another burst of heat to keep the copper tip at correct temperature. Normally only heavy irons have this capacity and take a long time to heat — and cool.

3. **Put this heating power right at the tip:**
A perfect iron has its heat source right at the surface of the tip — inefficient irons have their's up the barrel. The Superspeed range generate their heat on the copper tip itself, hence the intense concentration.

4. **Lets the tip run cool when not actually soldering:**
The tip stays tinned longer and lasts much longer because it switches off when you let go the handle. This feature plus a low heat conductivity stainless barrel keeps the handle cooler.

5. **One iron replaces several:**
With normal irons, you need several different sized irons to cope with various jobs and avoid the risk of dry or weak joints. Scope has designed an iron that does the work of any other iron from 10 watts to 150 watts.

SUPERSPEED USER SELECTION DATA

	Superspeed	Mini Superspeed
Low heat conductivity barrel	Yes	Yes
Non-corrosive barrel	Yes	Yes
Weight (without leads)	100 grm	50 grm
Heating up time for 40/60 solder from cold	5 sec.	5 sec.
Heating up time for aluminium solder from cold (450°C)	14 sec.	12.5 sec.
Heating up time for hard silver solder from cold (630°C)	32 sec.	29 sec.
A conventional iron to do the same work would need to be—	up to 150W	up to 75W
Diameter of barrel	9.5 mm	6.4 mm
Choice of copper tip shapes	Yes	No
Cable lugs fitted	Yes	Yes
User Preference Guide:		
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AM challenge: hifi/stereo?

While FM/stereo would appear to hold all the aces in the broadcast quality game, AM exponents are certainly not throwing in their hands. There is talk of better transmitters, better tuners and, believe it or not, a workable system of compatible AM stereo.

by NEVILLE WILLIAMS

Because AM (amplitude modulation) was the simplest system, at least from the viewpoint of the receiver, it became the "work horse" of broadcasting, with the emphasis on utility rather than on quality, in the hifi sense. The sound might lack bass in small receivers, treble in most, and stereo facility in all, but what did it matter for most of the material most of the time: news, weather, talks, drama, and a choice of tunes to suit the mood? On long-wave,. medium-wave and short-wave, AM has long been the basis of a vital, universal medium.

When FM broadcasting ultimately began on the VHF band, it exhibited lower background noise and wider frequency response but these qualities were appreciated mainly by those interested in hifi sound reproduction. As a result, FM broadcasting tended to be identified with this rather specialist group and, as such, was fated for many years to a minor and rather impecunious role.

When the stereo facility was added, FM gradually began to appeal to a wider audience and there has been a slow but perceptible shift in FM programming from the early hifi-good music formula towards the demands of the mass audience. This shift is now being seen as a threat to the established medium-wave AM broadcasters, who certainly do not want to see part of their audience lured away.

Seeking to underline their position, the AM broadcasters emphasise that their system has certain important advantages: Their signals permeate valleys and streets much better than VHF/FM, and produce less fading in car radios. At the economy end of the scale, AM receivers can be simpler than their FM counterpart. Noise and interference can be a problem but it tends to be over-stated; most listeners in most areas have a choice of AM programs substantially free from these hazards.

Champions of AM go on to stress that the very simplicity and ease of AM reception has generated a very frustrating situation: Because AM tuners will work with primitive aerials, they are expected to do so, noise and interference notwithstanding. And because AM tuners can be cheap and simple, most are made that way, even though in that form they sacrifice much of the treble response.

Largely as a result, few listeners realise that AM stations broadcast a range of frequencies far wider, and at far lower distortion than the average AM receiver will ever reveal. They might well be startled if they could hear the transmissions through tuners designed with the same dedication as their FM counterpart, and fed with aerials provided with the same deliberation.

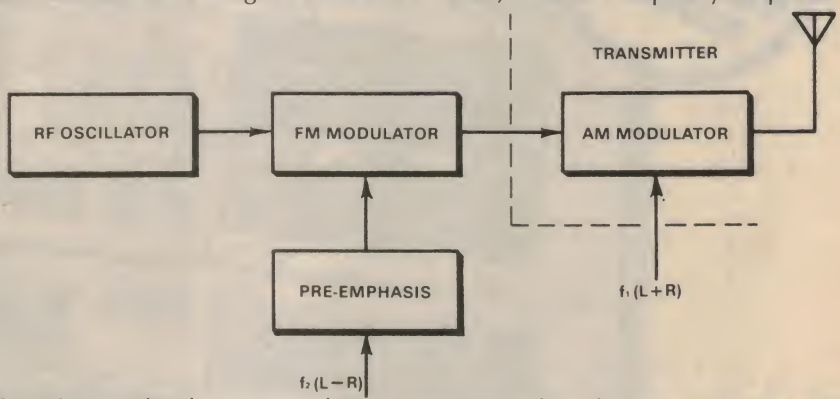
It is not only common, but normal, the AM broadcasters say, to find tuners and receivers in which a carefully designed FM/stereo tuner is paired with a very basic AM tuner, no more ambitious than found in a small transistor portable.

Yet the technology exists to produce much better AM tuners and receivers—able to retain more of the wanted "treble" sidebands, while rejecting those from adjacent stations. Somehow, listeners have to get the message that good quality AM reception is available right now for no more effort or outlay than is regarded as normal for FM. Some good quality AM tuners are available on the world market, but not many!

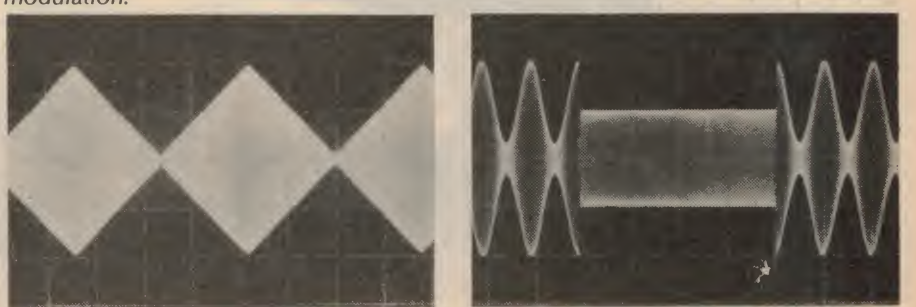
Curiously, one such tuner is produced by AWA in New Zealand and is marketed in the USA under its own type number, AM3, by McKay-Dymek.

McKay-Dymek has a new "state-of-the-art" AM tuner in development with crystal filters, digital readout, very low distortion and other features. They say that its price will compare with the better FM tuners but it will still be well below what some enthusiasts pay for exotic FM tuners of one type and another.

While the quality of tuners and receivers in the hands of the public is a constant source of discouragement to AM station engineers they do, nevertheless, strive for low distortion and a wide, smooth frequency response. In



RCA's diagram for the suggested AM/stereo transmitter. In many cases conversion would entail only replacement of the existing exciter with one capable of frequency modulation.



Left: triangle wave modulation of an RCA Ampliphase AM transmitter, showing the excellent linearity. Shown at right is a tone burst with no sign of bounce, ringing or overshoot.

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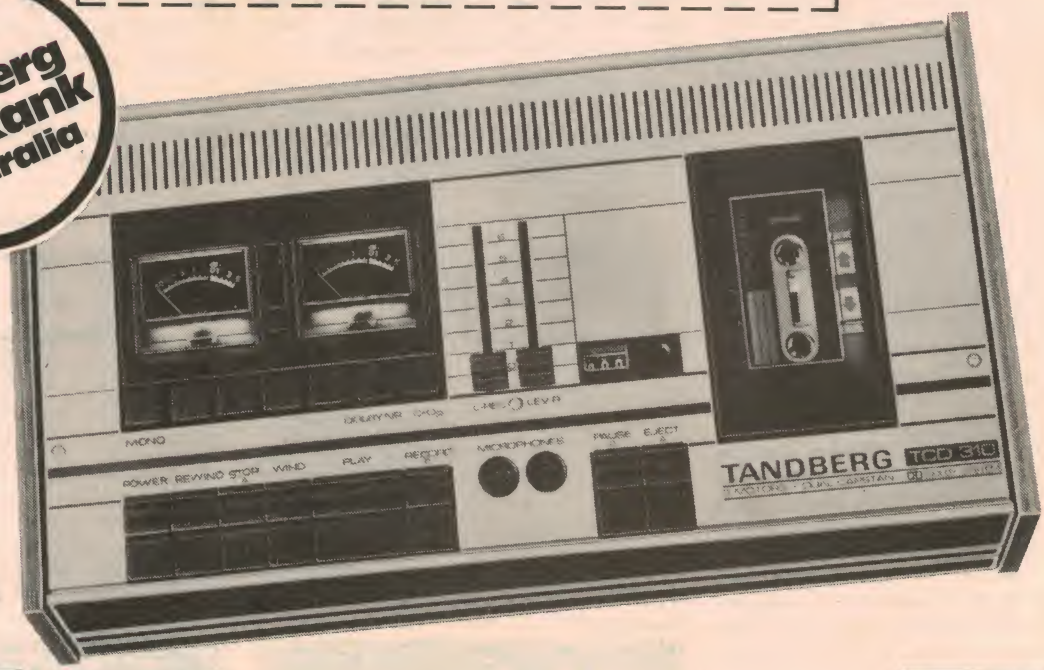

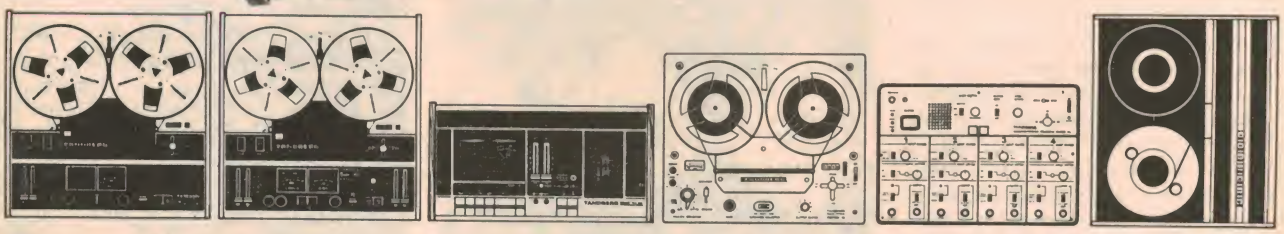

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fact, in Australia, as in many countries, a certain high standard of performance is mandatory. Provided a notch filter can kill any adjacent channel heterodyne at night, the signals from local AM stations should contain just about as much high frequency content as the average listener's ears can use.

AM transmitters typical of modern practice were exhibited by RCA at the recent NAB (National Association of Broadcasters) convention at Las Vegas. Described as the fourth generation of their "Ampliphase" series, they should meet the needs of broadcasters who are actively competing for audience support on the basis of "Hifi sound for AM"—surely an echo of the FM challenge.

In this market, the term "hifi sound" has special connotations, because it can mean sound which is still free from discernable distortion, even though it has been "processed" at audio level to increase its apparent loudness. RCA says that their new transmitters are "transparent": they will radiate without colouration whatever audio signal is fed to them, whether it be deliberately compressed or assymetric or at such a level that it produces actual upward modulation.

Intrinsically, the transmitters have a frequency response flat within plus and minus 1dB from 20Hz to 20kHz. Harmonic distortion never exceeds 1% in the range 50-10,000Hz, or 2% between 30 and 15,000Hz. No ringing or overshoot is evident in stringent tone-burst conditions.

With transmitters of this order of performance, the quality of the system is dependent entirely on the receiver.

But, of course, one big shortcoming remains. What about stereo, which has thus far been available only on FM?

One possibility that has been canvassed is that of transmitting a carrier with two dissimilar sidebands, representing the left and right channels. Hopefully, they would be resolved as a mono signal by conventional receivers and sorted out into stereo by specially designed tuners. For various reasons, this scheme does not appear to have been developed very far.

Recently, however, RCA came up with another proposition which was demonstrated at the NAB Las Vegas convention using headphones to highlight the separation which could be achieved.

The basic idea is that the sum (left plus right) signal is amplitude modulated on to the carrier, exactly as it is now when an AM station radiates a mono program from a stereo source. The signal therefore appears normal to a conventional AM receiver, so that compatibility is satisfied.

Additionally, however, the difference signal is used to frequency modulate the carrier, allowing a suitably designed tuner to resolve the additional mode and extract the L-R component. When this is matrixed with the L+R component in the normal way, the original stereo pair can be recovered.

While RCA set out the principles in the literature distributed at the NAB Convention, they do not give clear figures for the amount of frequency swing which might be acceptable in terms of existing AM receivers and existing bandwidth situations.

A channel bandwidth "at least 12 to 15kHz" is mentioned, which would most likely mean plus and minus 12 to 15kHz. This would probably be manageable in Australia, with the present density and distribution of stations, on the basis that proper stereo resolution would be expected only within each station's primary service area.

As for compatibility, RCA have accepted this as a prime requirement and it can only be assumed that the stereo signal would present no problems to existing mono tuners and receivers.

At the transmitting end, broadcasters would face three major problems:

All studio equipment and wiring would have to be converted or replaced—a major job in Australia where the vast majority of broadcasters are equipped for mono only.

All links and relay landlines intended for other than mono speech would have to be doubled-up and phase balanced for stereo.

Transmitters would have to be replaced or, at the very least, exciters installed with provision for frequency modulation.

Considering that the idea is merely at the proposal stage, practical AM/stereo is certainly not going to be on the doorstep tomorrow, but it's an interesting idea, nevertheless.

AUSTRALIAN "PIRATES": Apparently the American record and tape industry is not alone in its problems with illicit copies, sold in competition with the genuine article, but yielding no return to the writers, artists or the original recording company. What follows is a letter circulated to the industry from Alfred H.

PIONEER PRELUDE 600

Pioneer have announced the release of a new, complete hifi system, the "Prelude 600". Replacing the very popular Prelude 500 system, it uses a magnetic cartridge and a belt-drive turntable housed on a base with a hinged and sprung perspex cover. The amplifier is a new model, not available separately, type SA5300. It offers full control facilities, provision for tape and tuner input, and provision to switch to two pairs of loudspeakers, separately or together. The available power output is 14W RMS per channel.

Speakers are single wide-range 6½-inch units, ruggedised to handle the full available output power. Recommended retail price for the Prelude 600 is the same as for its predecessor: $299, plus $39 for the utility stand shown in the above picture. A manufacturer's guarantee covers the turntable for 1 year, the amplifier for 2 years and the loudspeakers for 3 years. (Pioneer Electronics Aust Pty Ltd, 256-8 City Rd, South Melbourne 3205, and in other capital cities).

TA—1130

TA—1150

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FROM A SONY WORLD OF RESEARCH — TWO SUPERB STEREO AMPLIFIERS

The TA-1130 is another superior hi-fi component developed for the ultimate in sound reproduction. **Power amplifier section:** Continuous RMS power output: (Less than 0.1% THD) At 20Hz-20kHz 50 + 50 watts (8 ohms) Both channels driven simultaneously. **Power bandwidth (HF)** 7Hz-30kHz, **Harmonic distortion:** Less than 0.1% rated output. IM distortion: Less than 0.1% at rated output. **Frequency response:** 10Hz-200Hz ± 2dB. **S/N ratio:** 110dB, network A, short circuited. **Residual noise:** Less than 0.008 μwatt/8 ohms. **Damping factor:** 100/8 ohms, at 1 kHz. **Inputs:** POWER AMP INPUT Sensitivity 1 volt (for rated output). Impedance 90k ohms. **Outputs**: SPEAKER terminals accept 4-16 ohm speakers. Equipped with 2 pairs of speaker outputs. Headphone jack accepts low — and high — impedance stereo headphone. **General:** System: All silicon-transistor stereo integrated amplifier Power amplifier section, direct output coupling, quasi-complimentary symmetry circuit (SEPP OTL), Preamplifier section, direct coupling equalizer amp, Capacitor coupled flat and tone control amp, Combined NF type and CR type tone control.

The TA-1150 offers outstanding features and performance: Low noise due to newly developed wide dynamic range linear IC used in pre-amplifier stage, Facility for four-channel master control with loudness compensation capability, Input and output facilities for two tape recorders — inter-recorder dubbing possible, Straight line level and balance controls, push button function selectors, extra auxiliary input jack on front panel, high and low filters, centre channel output, output terminals for two pairs of speakers, front panel headphone jack which accepts both 8-ohm and 10k-ohm phones, accessible preamplifier/power amplifier junction points. **Power amplifier section:** Power output: 30 watts per channel continuous (RMS). **Preamplifier section:** Frequency response, 15-80,000 Hz±2d. Filter, High Filter 6dB/oct, above 5kHz, S/N ratio: better than 70dB. **General:** Circuit; 26 transistors, 2 ICs, 3 diodes. Power requirements; 240V, 50Hz. Power consumption; Approx. 260 watts. Dimensions; 400mm(W) x 149mm(H) x 316mm(D), **Weight:** 8.2 kilograms.

SONY. for particular people

S/010

Watts, General Manager of the Australian Record Company Limited, of 11-19 Hargrave Street, East Sydney 2010.

The letter says:

Supplies of these items are making their appearance in various retail outlets in Australia.

As you are aware they have been made illegally and, as such, are "infringing copies" within the meaning of the Copyright Act 1968. Legal proceedings will be taken against those persons and organisations who become involved in their marketing in Australia.

In the meantime there is a job to do in locating and identifying the persons who are so involved and one of the most effective sources of information in this respect is the legitimate record retailer.

I am therefore appealing to each retailer—and to each Manager of a shop in a retail chain of stores—to pass on to our Branch Manager in his State (or direct to me if this is preferred) any information they may receive about the outlets at which these pirated recordings are sold or the sources from which such outlets draw their supply.

All information so received will be treated with the utmost confidence and privacy.

I do not have to tell you, of course, that pirated recordings are not only cheating the composers, the musicians, the performing artists, the producers, but also the legitimate retailer who loses business to the "pirate" outlet.

The features of a pirated product are that it is invariably very cheap, made from inferior quality materials in an inferior manner and appearance, wears out more quickly than the legitimate product and is presented without the legitimate label name and trade mark.

I would like to thank you in anticipation for your co-operation in this matter. (Alfred H. Watts)

Since the release of this letter, names have in fact been published and stocks of allegedly "pirate" recordings seized.

Representing a radical departure in styling, this new Yamaha TC800GL cassette deck has all its controls on what would normally be the top. But the "front" is cut away so that the player sits on the angled under surface, presenting the controls to the operator "staircase" fashion. Only preliminary details are available—in Japanese—but the deck appears to provide mic. and line mixing, playback level control and a vernier adjustment on speed. It is equipped for Dolby and CR02 tape, and has an automatic limiter and a memory, probably operating in conjunction with the tape counter. It has twin recording level meters, one of which is available for checking the battery supply. There is the normal range of push-buttons including a pause facility.

The TC800 is similar to the TC800GL model pictured, except that it appears to be intended for mains only operation. Frequency response is quoted in both cases as 30-13000Hz for normal tape and 30-15000Hz for CR02. Yamaha is represented in Australia by Rose Music Pty. Ltd., 17-30 Market St, South Melbourne 3205.

AKAI CASSETTE DECKS: Akai Australia Pty Ltd have announced a new series of cassette decks, plus a new reel-to-reel model.

Least expensive of the new cassette decks is the CS-34D, selling for $199. It has all the features which one expects to find in a good quality domestic deck: push-button control, including pause; slide recording controls with auto limiter; Dolby system and chromium tape provision; auto. stop in all modes; 3-digit counter and tape run indicator; microphone input and headphone outputs. & Wow and flutter is less than 0.13% RMS; response 40-13000Hz plus or minus 3dB with low noise tape, or to 15000Hz with CRO2; signal/noise, with dolby, 52dB.

The GXC-39D is a more expensive machine, retailing at $365. Slightly larger than the CS-34D, it is similarly styled, and has more ambitious specifications. It has a glass ferrite R/P head and memory rewind facility.

Retailing at $535, the GXC-325D has a double function ferrite R/P head which allows 3-head operation, including off-tape monitoring. A closed loop double capstan transport ensures up-graded mechanical as well as electrical specifications.

The reel-to reel deck is the GX-270D, with 3 motors, auto reverse, feather-touch function buttons, and glass and ferrite heads. Specifications are ambitious; the suggested retail price is $685. (Akai Aust Pty Ltd, 276 Castlereagh St, Sydney, 2000.)

Vacuum cleans your records

Most enthusiasts are familiar with brush-type record cleaners, which track the grooves being played by the pickup; they hopefully dislodge and retain particles of dust and fluff, so they do not produce clicks and plops. The "Groovac" unit illustrated on the left is a fine-haired brush mounted on its own carefully engineered arm—but it does not leave to chance the fate of particles dislodged from the grooves. Housed in the box and connected to the brush through a flexible tube and the hollow arm is a tiny vacuum cleaner mechanism which sucks up particles which collect on a filter at the output end of the box, permanently out of harm's way. Recently introduced on to the European market, the Groovac is being marketed in Australia by Hi-Fi Electrical & Co., 29 Wattle St, Rydalmere 2116. Tel. Sydney 638-7457.

CONFUSED ABOUT SPEAKERS ?

by GEORGE W. TILLETT*

Probably more nonsense is written about loudspeakers than almost anything else except deodorants and toothpaste. We read about marvellous new acoustic principles every few weeks (they usually turn out to be old ideas, long discarded) and we are told about Special Acoustic Tuning, Phase Compensated Enclosures, Phase Coherent Sound and so on.

There are speakers "specially designed for rock", others that rotate like calliopes and still others that splash the sound off the walls. Says one manufacturer "the secret of excellent performance lies in the use of a multiplicity of drivers" countered by "electrostatic speaker is superior due to the near absence of moving mass"

Omnidirectional radiation is said to be ideal, but makers of wide-angle systems disagree; so do those who say that a point source is the ideal to strive for. Reflected sound is claimed to give that concert hall effect in the home but the opposition says "... the resulting sound is phony ... when somebody comes up with a reflective design that presents a correct spatial perspective, we may change our mind". And so it goes ... No wonder the man in the street (or store) is more than a little confused!

Lord Kelvin said "I often say that when you can express it in numbers, you know something about it. When you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind". Well, you can judge an amplifier by its specifications pretty well—so many watts output within x dB between a and b frequency at z distortion etc., etc. But you can't describe loudspeakers in the same way. True, Most manufacturers will, if provoked, produce a frequency response curve showing the response from 20Hz to 20kHz—but this does not really tell us a great deal.

Translated, it simply means that if a signal is fed to the speaker, ranging from low frequencies up to the highest, a noise emerges at certain output levels which is picked up by a microphone placed at a certain distance (usually 3 feet) away. The measurements are nearly always made in an anechoic chamber (soundproof room with no reflective surfaces). Obviously, we do not normally listen to the music under these conditions—neither do we sit three feet from the speakers, but leaving these reservations aside, the fact remains that two speaker systems could have indentical response curves and yet sound entirely different. The reasons are many.

First, we have the problem of distortion. If a low frequency signal, say 40 Hz, is fed to a poor speaker, the resulting output might consist mainly of 80Hz, plus a smaller amount of genuine 40Hz. This kind of distortion (quite common with small bookshelf systems using bass speakers with inadequate magnet structures) is called *frequency doubling* and it won't show up on a frequency response curve.

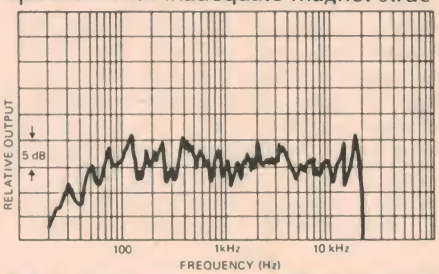

Fig. 1: The frequency response curve of a popular loudspeaker system using a 10-inch bass driver with a 2-inch tweeter. The response was measured at 3 feet on axis.

There are other kinds of distortion and some reviewers measure the Total Harmonic Distortion (THD) and convert the figures into a graph as shown in Fig. 3. This shows the distortion at 10 and 20 watts input for a typical high quality bookshelf sysyem costing around $300. As can be seen, the distortion increases

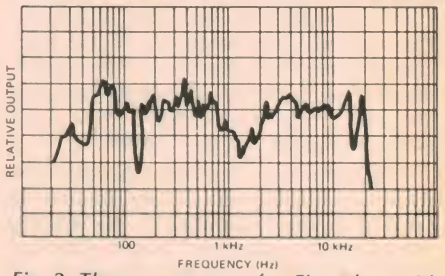

Fig. 2: The same test as for Fig. 1 but with the microphone moved a mere 4 inches!

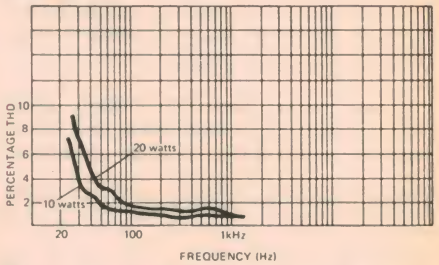

Fig. 3: Showing the harmonic distortion from a typical bookshelf system.

* George W. Tillett has been actively engaged in the electronics industry for more than 35 years and has designed some of the world's finest loudspeakers. He was Technical Director of Wharfedale in England until 1965 when he went to the US as Director of Engineering for Fisher. Two years later he joined Audio Dynamic Corporation as Executive V.P. and, late in 1969, became editor of Audio magazine. Subsequently he decided to go back into engineering and is now V.P. Engineering at EPI Products in Massachusetts. He is a member of AES and on the IHF committee on loudspeakers. He will be contributing articles from time to time to Electronics Australia.

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rapidly below 200Hz and the figures must look horrendous to those accustomed to thinking in terms of amplifier distortion of 0.1% or less. Fortunately, the human ear is tolerant of this kind of low frequency distortion and 5% THD at 40Hz would be inaudible—even to the most critical "golden ear".

Another important consideration has to do with dispersion, or how a loudspeaker radiates the sound. Some only radiate appreciable power at high frequencies in a narrow beam, like a flashlight. This would severely limit the listening area for a reasonable stereo image—hence the once popular expression—the "stereo seat". So, many test reports in technical journals include measurements taken at various angles (see Fig. 4) usually 45 and 60 degrees off-axis. Some carry this idea a step further and publish dispersion plots, or polar diagrams for several frequencies (Fig. 5).

Transient response is also important: all speaker cones or diaphrams, whether round or square, elliptical or oblong and made of paper, plastic or metal—all have

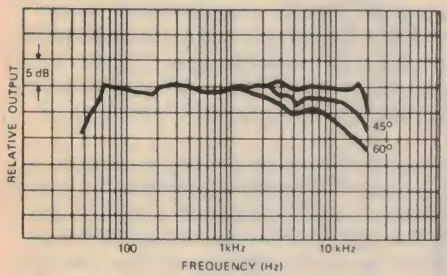


Fig. 4: Frequency response curves on axis (top), and at 45 and 60 deg. off axis.

mass. They cannot start and stop moving precisely with the applied signal. So much energy has to be used to start the relatively heavy diaphram moving that there is appreciable stored energy to dissipate when the signal stops.

That's bad enough, but the situation is complicated due to parts of the diaphram moving independently. In other words, They still keep going when the rest have stopped! And virtually none of this behaviour shows up in the response curve. So how are loudspeakers tested for transient response? One method is to apply a continuous tone or sine wave to the loudspeaker and interrupt this signal by a fast-acting electronic switch so you get a tone-burst waveform like that shown in Fig. 6.

Output from the loudspeaker is picked up by a microphone and then displayed on an oscilloscope. The test is repeated at different frequencies and poor transient response is indicated by the length of time the speaker cone takes to start or stop.

Fig. 7 shows the tone-burst response of a good loudspeaker; note that there is very little trace of overshoot or hangover—unlike Fig. 8. Here we have a really poor loudspeaker: not only does the waveform take a long time to start but there is considerable hangover or ring-

PUZZLED ABOUT SPEAKERS?

ing. (I might add that this particular loudspeaker was never marketed, it died a natural death in the laboratory in which it was born.)

Now, as far as the designer is concerned, tone-burst testing is an invaluable tool—but there are snags. A perfect waveform might be seen at say 100Hz, but just moving the frequency a few cycles either way could give a far different picture. This poses some problems for the unfortunate reviewer and so he has to select a number of tone-bursts to give a representative picture.

Power handling capacity is probably more important than it used to be, but most manufacturers supply figures. Unfortunately, there is no agreement on standards and so we have to contend with RMS power, music power, integrated program material, peak power, and so it is a matter of translation.

Sensitivity or efficiency can also be expressed in numbers—so many watts of electrical power for so much acoustical power output. But again, there are several standards of measurement. Most technical reviewers, and some manufacturers too, try to be helpful and relate the sensitivity to the amplifier power required for an average size room.

Of course, personal tastes differ widely and rock *aficianados* (especially those who live near me) listen at much higher sound levels than devotees of violin concertos and pieces for a glass flute. So the reviewer plays it safe and writes something like this ". . . the XYZ MkII is a fine loudspeaker but the sensitivity is below average and a minimum power of 20 watts per channel is needed for average size rooms." That wraps it up very nicely.

Colouration is a most significant speaker characteristic and one very difficult to evaluate. It can't be expressed in numbers. Every loudspeaker has it to some extent—it might be heard as a slight warmth in the upper bass or a certain brilliance in the treble. Or it could be an over-emphasis of the mid range frequencies. The causes are many—cabinet resonances, reflections inside the enclosure or dips and peaks in the response.

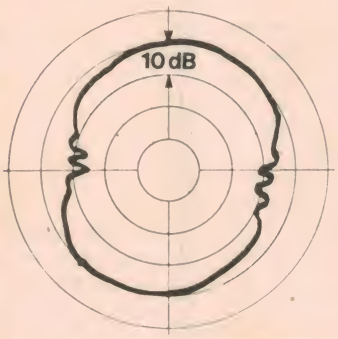
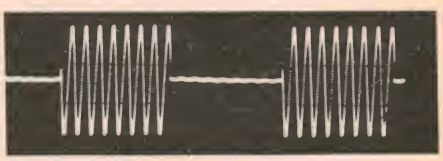


Fig. 5 (left): a loudspeaker polar diagram, plotted for 8kHz.

Fig. 6 (below): a tone burst as generated, 1kHz, 8 cycles on, 6 cycles off.



Most designers try and achieve a neutral sounding system and they do their best to remove the various irregularities and resonances, but there are others who deliberately introduce colourations, either because of personal preferences, lack of musical knowledge or because they believe many people want a certain kind of sound.

For instance, there is what is known as the "West Coast sound", characterised by a rise in the 2kHz to 6kHz band which produces a larger-than-life presence. This can sound very exciting at first but soon becomes tiring to listen to. Most studio monitors have this kind of artificial, projected sound.

By contrast, there is the "New England sound" which is fairly transparent and neutral with a full bass—and then we have the

"British sound", almost identical but with a lighter bass.

Few loudspeakers described as omnidirectional radiate sound all round—most of them have a reduced vertical dispersion so the sound field is really doughnut-shaped.

A large apparent source area is particularly well-suited for mono reproduction but it is less than ideal for stereo. Although the actual listening area is increased, the stereo image tends to be blurred and confused. Thus a vocalist who is located in the centre position will often sound if his (or her) mouth is stretched the whole distance between the speakers**.

But the various random reflections from the walls can give an exciting, spacious effect—especially to large orchestral works and some people prefer this kind of sound and will put up with a vague "double-mono" stereo, twenty-foot violins and all!

I have heard good quadraphonic sound with four omnidirectional speakers but the rooms were well damped, lots of heavy drapes and thick carpeting. In general, they would not be recommended because of the confusing effect of all the room reflections.

One of the big advantages of quadraphonic sound is not the ability to put a pianist in each of the four corners, but, more importantly, its potential to convey the spaciousness, the ambience of the concert hall or studio. Subterfuges to increase the sound source are neither necessary nor desirable. What then is the ideal kind of loudspeaker for quadraphonic sound? In my experience, those with a wide angle (90 to 120 degrees) dispersion are best but some authorities, like Ben Bauer of CBS, suggest* the use of dipole (figure) systems***.

Before leaving the subject of quadraphonics, let me try and answer the question—is it necessary for the rear speakers to be identical to those at the front? The answer is—yes, for best results. However, if a compromise must be made for certain domestic reasons, then choose speakers by the same manufacturers. Thus, AR 3A's up front will work happily with AR 4X's or AR7's at the rear and EPI 50's will match the EPI 150's, the smaller Advent with the larger Advent and so on. If speakers with widely differing characteristics are used together there will be a danger of the stereo image wandering in an unpredictable manner.

The best place to compare loudspeakers is in your own home as room acoustics play an important part in sound quality. In fact, acoustically speaking, the room must be considered as an extention of the loudspeaker—a concept that will not appeal to the woman who sees her living room as a showplace for the Louis XIV furniture! But it's true nonetheless.

You will find few dealers who will let you try out speakers at home (unless you are thinking of selling the family car and buying a pair of $1000 corner horns), so will have to make the choice in the store. You will still need to find a co-operative dealer, preferably one with a reasonably quiet demonstration room. Few things can fray the nerves like listening to music in a noisy, crowded showroom, surrounded by refrigerators and washing machines—and standing up into the bargain!

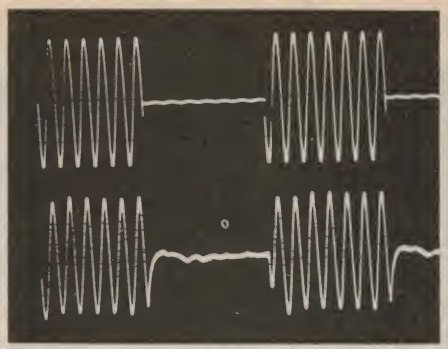


Fig. 7: The original tone burst signal (top) and, below it, the tone burst response from a good loudspeaker.

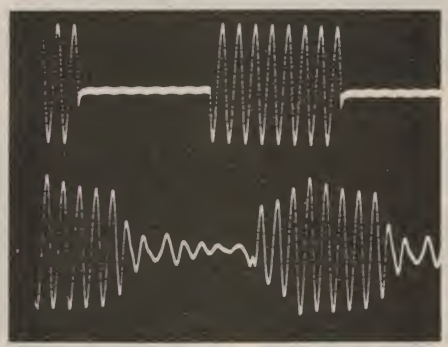


Fig. 8: The same test as depicted in Fig. 7 but performed on a loudspeaker with poor transient response.

First, you must have some idea how much you want to spend, and whether you need bookshelf or floorstanding models. You will probably have read the reviews or heard speakers you liked at audio shows or friends' houses and so you have narrowed down the choice to three or four possibles.

Take along some of your favourite records by all means—and, if you are married, bring your wife. If you get carried away and decide to spend more money than the budget allows, then it will be a joint decision and you should not be blamed (you will though) if there's nothing left for that new coat!

Seriously, music in the home should be the concern of both partners and the decor has to be considered, too. The first step is to place two of the probables side by side. Don't try and listen to more than two systems at once or you will get confused. Pick the better one and then compare it with number three and so on. The two on test should not be too far apart, otherwise room effects may swamp any differences. A speaker on the floor will give more bass than an identical model up on a shelf.

What to listen for? Male speech is a good test; the voice should be natural with no sign of that chesty colouration (watch out for those close-miked commercials that, figuratively speaking, put the announcer in a barrel. It's supposed to give a confidential air of honesty to the huckstering.

String tone ought to be smooth without harshness or that 'barbed wire' sound. Listen to orchestral climaxes—there should be no muddiness or discordency (unless intended by the composer). Bass line should be solid and well defined, the double-bass for instance should be reproduced cleanly without boom.

Actually one of the best tests for coloration and dispersion is "white noise". This is a random sound, not tuned to any particular frequency, and it can best be described as the hiss of escaping steam. A close approximation is the interstation hiss from a FM receiver—but make sure that the mute switch is off.

All kinds of boxiness, peaks, resonances, hollowness and ringing are shown up by a white noise test. All you have to do is listen carefully. Dispersion can be checked by walking in front of the loudspeaker, about six feet away. The character of the sound should not change much, although the level will fall at the sides.

Finally, if the dealer is not too impatient, listen to a pair of the best speakers, the contest winners, in stereo.

Here are some tips:

The loudest systems will tend to sound the best, so adjust the volume control accordingly.

Three-way systems are not necessarily better than two-way, neither are those with four speakers better than those with three, etc., etc.

Beware of so-called private label-speakers, some are made by firms of repute but the majority are pretty poor. They usually have a ficticious list price so the dealer can offer a package deal at an attractive price.

Don't forget that some speakers have level controls at the rear and at least two models have controls tucked away behind the grille cloth.

*"Quadraphonic sound needs directional speakers" Ben Bauer, Audio, March 1973.
**"In all directions" John Crabbe, Audio, March 1973.
***Examples: Dayton-Wright ESL, EPI Microtower 1, ESS Heil, Quad ESL, Amcron Aurilinear

One of four speaker arrays used to cover the 100,000 seat Los Angeles Coliseum.

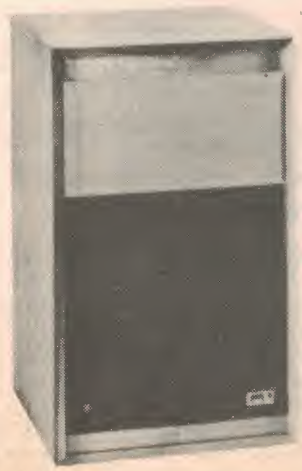
How many speakers do you know could wipe out an entire football stadium?

Up to 80% of the good electrified bass performed in concerts and studios in the United States eminates from Cerwin-Vega speakers.

They are the same speakers that were used to create movie realism in the film "Earthquake". If Cerwin-Vega can produce brilliant sound at these "high distortion risk" levels, imagine how fine the quality will be on your stereo system.

And with Cerwin-Vega you never need a monster amplifier to get realistic sound levels. The 211R for instance is a classic example. An amplifier with as little as 5 watts RMS will drive these speakers at least 10 db louder than almost any others, yet these same speakers will take a full 100 watts RMS and produce a sound level of 116 db without distortion.

If Cerwin-Vega speakers can wipe out a stadium and simulate an earthquake, imagine what they could do in your home.



Model 211 (R)
Maximum Power Input:
100 watts RMS; 200 watts peak
Flat Frequency Range:
32-20,000 Hz ± 3½ db
Maximum Sound Levels:
116 db @ 4 ft. @ 100 watts
Dynamic Range:
76 db in a 40 db noise field
Crossover Frequency:
1500 Hz, 3000 Hz
Speaker Elements:
LF: 12 in., 18 Hz resonance, 2 in. voice coil, 13 lb magnet system, foam ½ roll annulus, 16,000 gauss, 1 in. p-p movement (L-123-W)
HF: 2½ in. dhorm, 1 in. phenolic diaphragm, 18,500 gauss (UHF-91)
MF: 1-(HF-91) Horn driver assembly
Configuration:
rectangular direct radiating with controllable upper mid reflection
Dimensions:
15½D x 15W x 26H

And unlike most manufacturers, every component that goes into a Cerwin-Vega speaker is made by Cerwin-Vega.

The advantages of doing this are obvious as we have complete control of the manufacturing process all the way. Everything from the voice coil to the oiled walnut finish of the speaker cabinets.

These newly introduced speakers were designed especially for people who want truly professional sound in their own home. You would be crazy to consider anything else before you hear them – and probably beyond redemption to consider anything else afterwards.

Distributed by Magnecord International Pty. Limited, 218A Crown Street, Sydney.
Tel. 33 4775.

88518

Sansui AU-2200 stereo amplifier

A new range of stereo amplifiers has been introduced to the Australian market by the distributors of Sansui high fidelity equipment. Here we review the Sansui AU-2200, which is conservatively rated at 10 watts RMS per channel.

Styling of the Sansui AU-2200 is typical of many Japanese amplifiers today. It has a large control panel with controls spread out so that it is easy to use. There are four small knobs which provide controls for Balance, Bass and Treble and Loudspeaker system Selector, which also does duty as the Power switch.

Five push-buttons are provided for input selection and for tape monitor. Two toggle switches provide a loudness facility and a High filter. Jack sockets are provided for low-impedance headphone and a dynamic microphone, while a DIN socket allows connection of a tape deck. The large knob is the volume control. A light-emitting diode is used for a pilot indicator.

The array of connections on the rear panel is also fairly typical. Phono sockets are used for input connections while two sets of screw connections are provided for loudspeakers. Two-pin mains outlets are also provided, one switched and one unswitched.

While it may seem fairly typical from the exterior, the AU-2200 is really one of a new breed. It uses no discrete transistors at all (and no valves either). Instead, all active circuitry is provided by integrated circuits.

Indeed, when the top cover is removed, the amplifier chassis looks remarkably bare. On the left, looking all alone, is the power transformer and to the right of it is the power amplifier PC board which accommodates both channels. Contributing to the impression of bareness is the relative lack of point-to-point wiring. As can be gathered, accessibility is not a problem.

One large PC board and two small boards accommodate all the small signal circuitry of the amplifier. The integrated circuits used are interesting in that they are seven-pin in-line encapsulated units. In fact they are quite insignificant looking, and first glance at the boards could give the impression that there is no active circuitry at all. (The mind boggles at that thought.)

The power amplifier integrated circuits appear to be of the hybrid/thick film variety. They are mounted directly on a large flat heatsink and have 10 pins for connection to the PC board.

Power supply circuitry is fairly modest. A bridge rectifier feeds a single 1500uF/50VW reservoir capacitor which seems quite small by comparison with capacitors of the same value from just a few years ago. Such is the progress in capacitor manufacturer!

Output coupling to the loudspeakers is via 1000uF/35 electrolytic capacitors. We were a little surprised at this. It would seem that it would be easy to obtain these power IC's with the ability to run from balanced supply rails and thus eliminate the coupling capacitor. This is an advantage as far as obtaining a good damping factor is concerned, but admittedly it could be a disadvantage in a simple amplifier as a failure in one of the IC's could lead to loudspeaker damage. Sansui have presumably considered all these possibilities and opted for output coupling capacitors.

The tone control circuitry is interesting in that it consists of a passive control network preceded by an operational amplifier stage to make up the gain losses. This approach is often more practical than having a negative-feedback tone control circuit as these can be difficult to render completely stable when built around an operational amplifier IC.

A common problem in amplifier design occurs with the balance control particularly if a single-element potentiometer is used. This sort of control tends to be a compromise between control action and insertion loss. If the "control" is not to be concentrated at the extremes of rotation, insertion loss must be made fairly high.

Sansui have produced an elegant solution to this problem by using a dual ganged potentiometer with special complementary tapers. This results in a very smooth and satisfactory control operation.

High level inputs such as tuner and auxiliary are connected directly via the input selector switches to the amplifier stages preceding the tone control. The magnetic cartridge input is amplified and equalised by a separate operational amplifier IC.

We were interested in measuring this amplifier as the low level noise performance of IC's has tended to be less than satisfactory in the past. We might state, at this point, that Sansui have this problem licked.

Rating of this amplifier is best described as conservative. This would seem to be in line with requirements of the vast American high fidelity market, which is now regulated fairly stringently by the US Federal Trade Commission.

Power rating is 10 watts RMS per channel with both channels driven. Rated distortion is 0.8% and frequency response at a level of 1 watt is quoted at 30Hz to 40kHz within plus 1dB and minus 2dB. These ratings were easily met by our sample AU-2200.

We measured power output at 12 watts per channel with 8-ohm loads with both channels driven, and this rose to 15 watts with one channel driven. With 40-ohm loads, power was 11.5 watts per channel, with both channels driven. With 15-ohm loads, power was 9.5 watts per channel, again with both channels driven.

Harmonic distortion was 0.15% at full power into 8-ohm loads and was generally less than this figure at lower powers. Crossover distortion products were commendably low.

Frequency response of the high level inputs was flat within 1dB from 15Hz to 40kHz.

(continued on page 19)

No matter what you want in a speaker, hear it is.

Whatever you want in a speaker—we've got the lot. Whether you want to build a new system or upgrade an already existing one, Plessey have a complete range of loudspeakers, midrange and tweeters—everything you could ask for in high quality high fidelity sound. Plessey offer not only the best results but also the best sound value.

WOOFER & WIDE RANGE LOUDSPEAKER	POWER HANDLING	FREQUENCY RESPONSE
KC6M	8W RMS	50Hz-11kHz
KC6MX	8W RMS	50Hz-20kHz
C60	10W RMS	35Hz-7500Hz
C60X	10W RMS	30Hz-17kHz
C80	20W RMS	35Hz-8kHz
C80X	20W RMS	35Hz-20kHz
C100	20W RMS	40Hz-11kHz
C100X	20W RMS	40Hz-20kHz
C12P guitar	30W RMS	55Hz-10kHz
C12P woofer	30W RMS	35Hz-10kHz
C12PX wide range	30W RMS	35Hz-13kHz
C12PX guitar	30W RMS	55Hz-13kHz
12U50	50W RMS	25Hz-11kHz
12UX50	50W RMS	40Hz-13.5kHz
MIDRANGE		
C6MR	20W RMS	450Hz-6600Hz
KC5MR	15W RMS	700Hz-14kHz
TWEETERS		
X20 horn	—	3kHz-30kHz
X30 dome	—	3kHz-30kHz
KC 3G X cone	—	1.5kHz-19kHz
5FX cone	—	4kHz-20kHz

PLESSEY

Plessey Australia Pty. Limited,
Components Division,
The Boulevard, Richmond, Vic. 3121

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AR68

New microphones from Primo

Latest additions to the well-known "Primo" range of microphones from Japan are a sturdy desk-type dynamic for paging and base station applications, and a modest cost electret capacitor model for high quality recording work.

The Primo model DM-1487 is a desk-type dynamic unit in a stylish and rugged housing of die-cast metal, finished in hammertone. It has a response tailored for communications work, and is fitted with a push-to-talk button which has additional contacts for the control of an amplifier or transmitter system. There is also a locking device, so that the button may be locked down for "hands free" operation.

The dynamic insert of the DM-1487 features high sensitivity, and an omni-directional characteristic. It is dust and moisture-proofed, to ensure high reliability in typical commercial and industrial situations. The frequency response is 3dB down at approximately 150Hz and 7kHz, with a gradual bass roll-off and a slight treble peak at 4kHz to give crispness in low bandwidth communication work. The matching impedance is switchable between 600 and 50k ohms, the two most often used levels.

In short, the DM-1487 is very suitable for two-way radio base station use, in such situations as taxis, police, airports, civil emergency services and so on. It would also be a good choice for PA and paging systems, and for radio amateurs seeking a high quality unit for the "shack".

Somewhat in contrast is the Primo model EMU-522, a very high quality capacitor microphone featuring an electret insert, a built-in impedance matching FET preamp, extended frequency response and a well-tailored cardioid or "uni-directional" directivity pattern.

This microphone is very slim, only 20mm in diameter, and 177mm long. It is attractively finished in brushed metal, with a black anodised grille, and comes complete with slide-on foam windshield, a clip-on tilting holder, table stand, and plastic carrying bag. The microphone has a permanently fitted 5 metre cable, with a 6.5mm phone plug.

The microphone case contains an "AA" penlight cell which provides power for the FET matching preamp. Access to the cell for replacement purposes is gained by unscrewing the case, about one-third down from the front. The nominal output impedance of the preamp is 2k ohms, but the microphone appears to work quite satisfactorily into a nominal 600 ohm load.

The response of the EMU-522 is very smooth, and extends from less than 40Hz to virtually 20kHz. The smooth and extended treble response is no doubt partly due to the very small active diameter. This and the design of the rear-loading slot system also gives the microphone a very well tailored cardioid characteristic, with a typical front-to-back ratio of around 20dB from 400Hz to 6kHz, and better than 10dB from 150Hz to the upper frequency limit. Sensitivity is quoted as –71dB 3dB, and the overall signal to noise ratio 47dB.

Above is the Primo DM-1487 desk-type dynamic microphone and below is the EMU-522.

The sample unit pictured was tested in a variety of recording situations, and gave very impressive results. Treble response was very smooth and clean, and the bass response extended well down without any evidence of doubling—so that it should be excellent for such applications as organ recordings. With the

(continued on page 107)

SANSUI AU-2200

RIAA equalisation for the phono inputs was within 1dB from 30Hz to 15kHz.

Phono sensitivity was quoted at 2.5mV but actually measured 1.5mV at 1kHz while overload capability at the same frequency was a very good figure of 110mV. Indeed, most manufacturers provide more than adequate signal handling capability, for the phono inputs these days. Quite a different story from a few years ago.

Damping factor which is a measure of an amplifier's ability to control unwanted low frequency resonance effects in the loudspeakers is rated at 30 for an 8-ohm loudspeaker. We obtained this figure at 1kHz. However, at low frequencies, where it matters, damping factor is reduced. At 25Hz, for example, damping factor for an 8-ohm load measured just on five. This could easily be improved by increasing the size of the loudspeaker output coupling capacitors.

Another minus feature of the amplifier—which it admittedly shares with many others—is the High filter performance. This is quoted at 6dB/octave above 7kHz. In fact, it is closer to about 3 or 4dB/octave which is such a gradual rate of attenuation that it might just as well have been omitted altogether.

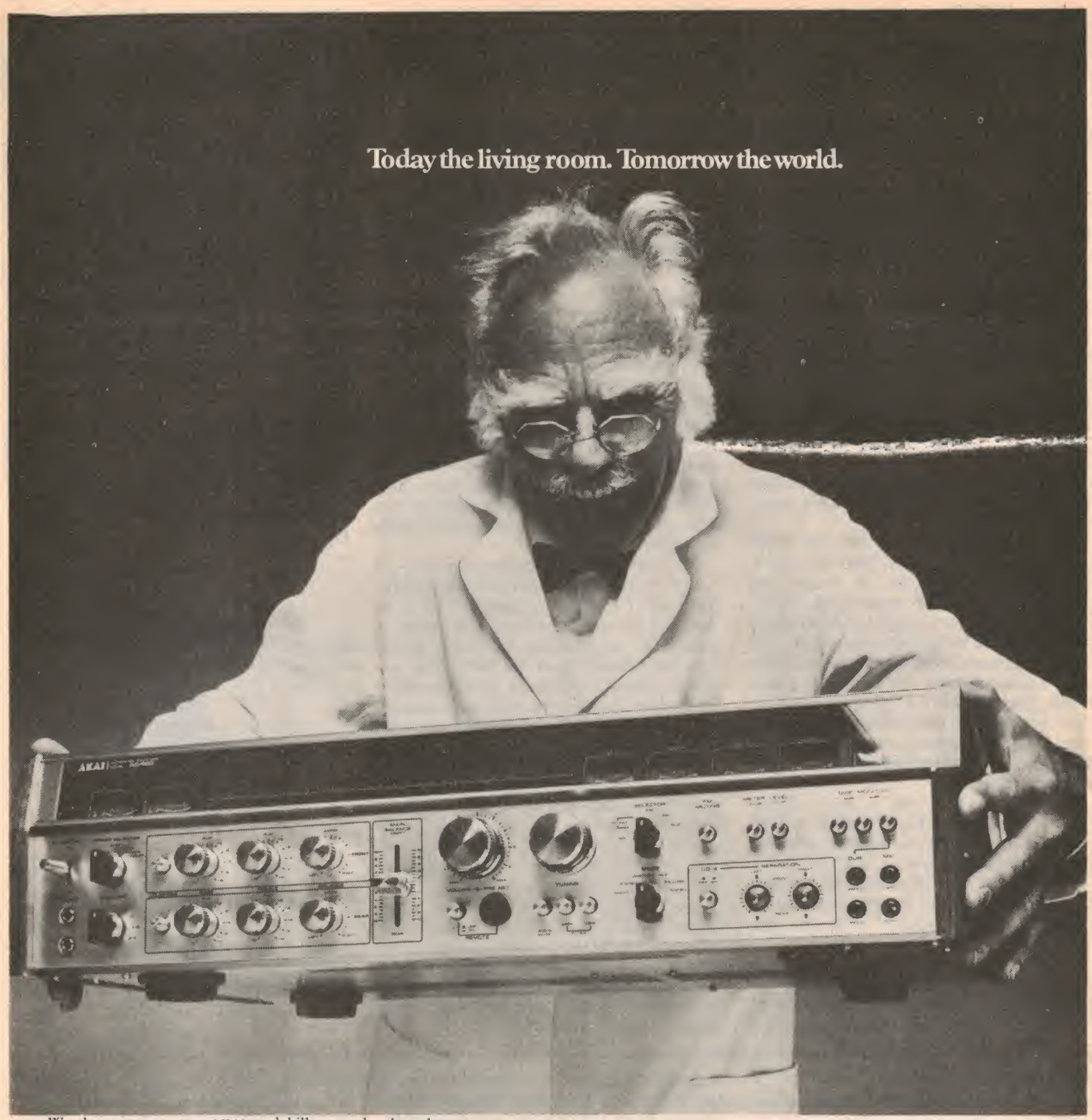
Signal-to-noise ratios for high level inputs, referred to 10 watts measured minus 74dB. For the phono input, the measurement was 75dB referred to 10 watts output and an input signal of 10mV at 1kHz. These figures are very good indeed and result in an amplifier which is very quiet at all control settings.

Square wave response of the amplifier was very good, as could be expected from the frequency response characteristic, and stability with capacitance shunting the loads was exemplary. No problems with RF breakthrough, either.

In operation, the amplifier is a pleasure to use and in fact is the sort of unit you quickly take for granted—it's there, you use it and that's that. No hassles.

In short, the Sansui AU-2200 is a straightforward stereo amplifier with all the features that most users require. It will probably be just as popular as its famous predecessor, the Sansui AU-101.

Recommended retail price of the Sansui AU-2200 is $189.00 and it is available from high fidelity retailers throughout Australia. Further information on Sansui equipment can be obtained from the Australian distributors, Rank Industries Australia Pty. Ltd., of 12 Barcoo St., East Roseville, N.S.W. (L.D.S.).



We plan to stay on top, AKAI model illustrated AS980. Recommended retail price $925.00. It delivers all known forms of reproduction. Mono, stereo, 4 channel:–Matrix–SQ–Discrete –CD4, plus a highly sensitive AM/FM tuner which even includes facility for 4 channel FM broadcasts.

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AKAI

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*The AKAI Complete Protection Plan warranty does *not* cover equipment purchased outside Australia.

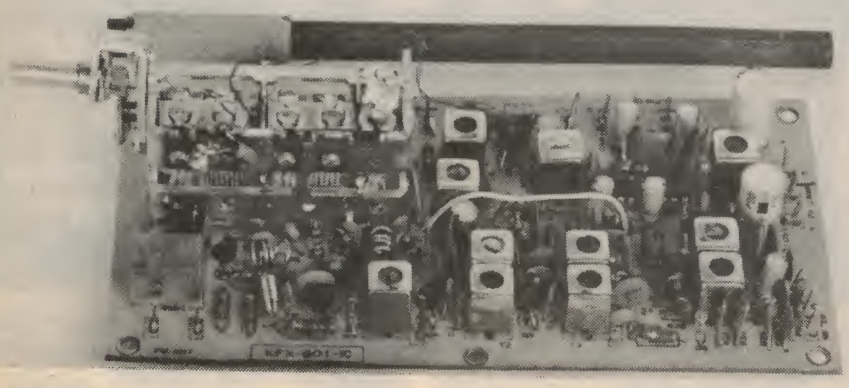
70592

An economy FM/AM tuner

If your pocket does not stretch to a complete AM/FM tuner, then this little module from Dick Smith Electronics may be just the thing for you. It provides all the electronics for a complete AM tuner, as well as a stereo tuner for the new FM band, for an outlay of only $29.00.

The module is contained on a printed circuit board measuring 85mm x 165mm. The overall height is 65mm. No cabinet or metalwork is supplied, the tuner being intended to be built into a suitable enclosure.

The right and left outputs are also made available at tags on the PCB edge, near to that for the AM output and a common connection. Unfortunately, the identification for the left and right outputs has been transposed, so that the left output is labelled right and vice versa.



Although we were not supplied with a circuit diagram, we were able to draw a few conclusions by inspecting the unit. There are six transistors, seven diodes and one integrated circuit, which is the stereo decoder for the FM section.

The input circuitry for the FM tuner appears to require a 300 ohm balanced aerial. The AM tuner has a built-in ferrite rod, which is supported on nylon spacers above one edge of the PCB.

Due to the lack of specifications, we were unable to determine the nominal tuning range. But from measurements it appears that the FM section covers the 88 to 108MHz band, while the AM section covers the normal AM band, from about 500 to 1600kHz.

Provision is made for the addition of a signal strength or tuning meter. We found that a meter with a sensitivity of 50uA or so was required to give a usable deflection.

Bias switching is provided to select either AM or FM modes. This is normally used in conjunction with the output switching, to reduce the interference between the two tuners.

The AM output is fed directly to a tag on the edge of the board, while the FM output is passed through an integrated circuit switching decoder, to derive the left and right stereo signals from the composite signal provided from the FM discriminator.

De-emphasis is applied to the FM outputs, to compensate for the transmitter. The standards proposed for Australia have a 50us time-constant, so that it is necessary to have a 50us time-constant for the de-emphasis. The de-emphasis as fitted to the tuner has a 75us time-constant, so that it would be necessary to alter this to suit the Australian broadcasts. Fortunately, this is relatively easy to do, requiring only that two capacitors be changed to slightly lower values.

There is provision on the PCB for the usual stereo pilot light, which indicates that a stereo signal is present and is being decoded. A 47 ohm resistor is included in series, so that a standard 6V 100mA incandescent light can be used. Alternatively, by increasing this to a suitable value, a LED may be used, at a much reduced current drain.

Having available an FM/stereo signal generator, we were able to check some of the performance characteristics of the stereo decoder. The 38kHz leakage was found to be −25dB and −26dB respectively for the left and right channels. Using a 15kHz sharp cutoff filter, we measured the left-to-right separation as 34dB, and the right-to-left separation as 30dB.

The reference level for these measurements was a 1kHz signal, applied to both channels so as to give a 75kHz deviation.

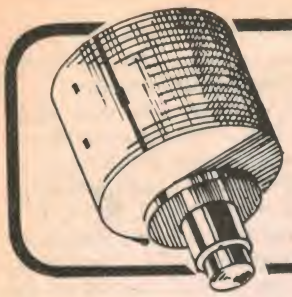
We found that the frequency response was 2dB down at 15Hz, and 3dB down at 17kHz, measured with respect to a nominal 0dB at 1kHz. This was done using a signal with a 75us pre-emphasis, to suit the de-emphasis of the tuner.

The module requires a supply voltage of +12V, and draws about 20mA, plus the current required for the stereo indicator. When using a LED, it would be possible to draw a total current of the order of 40mA. This could normally be provided from the power supply of the amplifier used in conjunction with the tuner.

In a normal domestic situation, the module could be built into a suitable cabinet, and used in conjunction with a stereo amplifier, feeding into the auxiliary or tuner input. Apart from the provision of a dial and tuning knob, the only other components required would be an FM/AM switch and a suitable stereo pilot light.

For use in a hi-fi situation, it would probably be necessary to add some type of filter unit to further attenuate the 38kHz components in the FM output, particularly where it is desired to make tape recordings off air.

Although this tuner is not perhaps of the very highest quality technically, it must surely rate as excellent value for money at $29.00. It is available from Dick Smith Electronics, 160-162 Pacific Highway, Gore Hill, N.S.W. 2065. (D.W.E.)



News Highlights

Domestic telecom satellites for Indonesia

The Indonesian Government has awarded two contracts totalling $US71.1 million to wholly-owned subsidiaries of Hughes Aircraft Company of California (USA) to build a domestic synchronous satellite system—the first in the Eastern Hemisphere.

When the system becomes operational sometime after mid-1976, it will tie together 120 million Indonesians on islands stretching from Sumatra to West Irian by telephone, telegraph, television and teletype.

Moenandir Mangoendiprodjo, first director of Perumtel, the Government-owned telecommunications company, said that a contract for $US23.6 million has been awarded to Hughes Communications International, Inc. (HCI) to build two satellites. A second contract for $US47.5 million has been awarded to Hughes Aircraft Services International (HASI) to build a master control station and nine earth stations at the company's space facility at El Segundo, California.

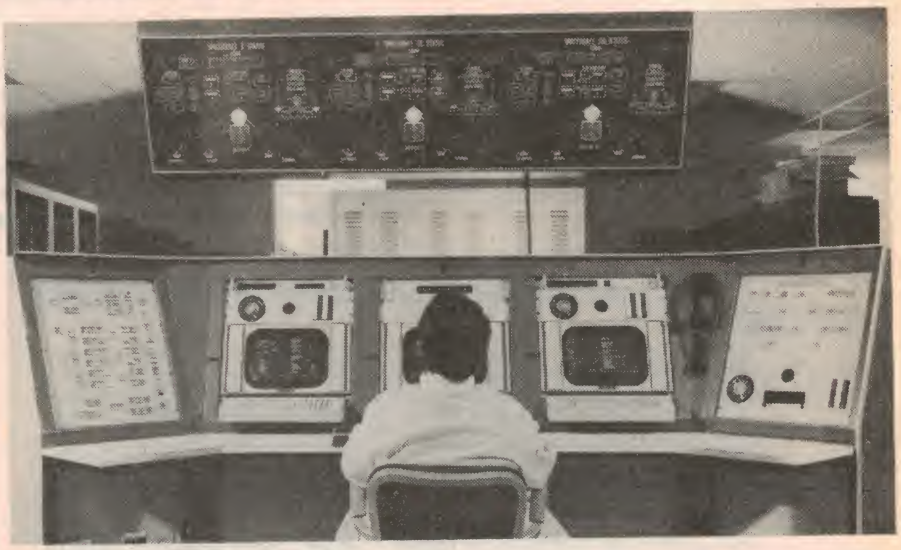
The remaining 30 earth stations will be purchased from other contractors.

Paul Visher, president of HCI, who signed the contracts, predicted that as many as 20 nations will be using domestic satellite systems for national or regional communications within the next decade. Countries currently considering similar domestic satellite communications systems include Australia, Brazil, Iran, and the Arab nations.

The first of Indonesia's 543kg satellites is scheduled for launch in 1976 by the US National Aeronautics and Space Administration from Cape Canaveral, Florida, into a 36,000 kilometre synchronous orbit over the equator. The second satellite is expected to be launched within two years.

Each satellite provides a maximum capacity of 5,000 two-way telephone circuits or 12 television channels, or various combinations of both. Indonesian officials have indicated that the nation will use only a portion of the total satellite capacity during the early operational phase for telephone and television transmissions. Future plans include a national radio network, transmission of data traffic, expansion of the country's telephone network, and the lease of satellite capacity to other users.

—George E. Toles.



Indonesia's new tracking station will be similar to the one pictured above, as built for the US Westar satellites.

At left, two Hughes technicians hold an illustration showing how the satellite's antenna will cover the Indonesian islands.

Electronics convention

The keynote address at the "International Electronics Convention, 1975" will be given by Mr. David R. Israel, Deputy Associate Administrator for Engineering and Development for the US Federal Aviation Administration.

Mr. Israel is responsible for the FAA's broad research and development program for air traffic control systems. The topic of his address will be "Electronics in the Future of Air Traffic Control".

The convention has been organised by the IREE, and will be held at the University of NSW from August 25-29.

Solar energy experiment at Aachen

An important energy conservation experiment has been initiated at Aachen in West Germany by the Philips company, supported by funding by the West German Government and RWE, the major power company. The program—an experimental solar house—is intended to prove that it is possible to save some two-thirds of primary energy input to a normal dwelling by capturing solar heat and by extracting residual heat from waste water and stale air.

Main interest in the experiment is centred around a unique solar panel developed by Philips. The panel is based on the use of black indium oxide coated water tubes running inside evacuated glass tubes for better radiant heat transfer. Eighteen of these panels, inserted at an angle of 45 deg C into the roof, are used in the solar house at Aachen.

The new solar panels are claimed to

(Continued on page 23)

Solar experiment . . . from p. 22

be far more efficient than conventional metal collectors, particularly in overcast conditions. On average, the bank of panels used at Aachen produce a steady 3kW output, sufficient to maintain the contents of the huge storage tank at 90 deg C under normal conditions.

Included in the project are two process control computers, intended to monitor the performance of all equipment in the experimental solar house. Apart from the solar heater panels, those systems under test include a heat pump which extracts heat from the ground under the house, the heat exchanger which takes warmth from outgoing waste water, the air exchange system which takes the heat out of stale air, and an air intake heating/cooling system.

The results of this work are expected to show which system or systems are the most efficient in heat recovery and storage. This should eventually lead to the development of heat recovery "packages" for installation in new buildings, and possibly for retrofitting to existing buildings.

AWA launches new colour TV camera

A new camera that will significantly contribute to colour television coverage in Australia has been launched by Amalgamated Wireless (Australasia) Limited, a major supplier of colour television equipment.

AWA, in conjunction with a sales team from Marconi in the United Kingdom, recently demonstrated the portable camera to major broadcasters in Australia. AWA are the distributors of Marconi broadcasting systems in Australia.

The new colour camera, a Marconi Mark VIIIP portable, has been designed to produce high quality pictures which can be directly inter-cut with conventional studio camera pictures without degradation of picture quality.

For the first time in the world, the Mark VIII portable camera was used "on-air" recently by Channel 7 on their Big League Football coverage. Immediately after the Channel 7 broadcast, the camera was again used "on-air" by Channel 10 in their Amco Cup broadcast from Leichhardt Oval, where the low-power

flood-lighting places demands on both equipment and crew for quality results.

Both these channels have recently taken delivery of Marconi Outside Broadcast Vehicles to extend their colour coverage of remote events. The introduction of this new camera integrates ideally with their already extensive facilities.

The standard Mark VIII features of automatic alignment and automatic colour balance have been retained on the portable unit. These facilities are particularly important for portable cameras which are sometimes subjected to very rugged treatment.

Computer responds to voice commands

Dr Martin Ackroyd, head of the Cognitive Systems Section at EMI, England, talks to a desk-sized computer that is programmed to understand spoken words and convert them into digital signals. This revolutionary computer, developed jointly in America and England, is already available for commercial use. So far, it is capable of understanding and acting on a vocabulary of up to 150 words or short phrases (in any language or dialect), and further research is underway to improve this. The system is immune to background noise in factory or workshop locations, and is thought to have potential in scientific, commercial and industrial applications.

Ionospheric bubble boosts VHF signal range

The range of certain VHF radio and television signals can be increased 20 or more times by a new technique demonstrated by scientists at Stanford Research Institute (SRI).

The scientists have demonstrated that a temporary man-made bubble can be produced in the ionosphere which reflects such signals back to earth. This makes it possible to extend their range to a point 1,600km or more from the original transmitter. Normally, these signals would pass through the ionosphere and are limited to a range of about 80km in a direct line from transmitter to receiver.

The bubble is produced by heating the ionosphere with a beam of shortwave radio signals from a ground-based antenna. This heating effect is based on principles similar to those employed in microwave ovens, and produces a bubble with a diameter of some 160km and a thickness of about 16km. Though invisible to the naked eye, this region can be photographed with an infra-red camera.

The scientists envisage the most important commercial applications of the new technique as point-to-point communication of telephone, teletype and facsimile, as well as mobile radio, especially in countries that lack modern communications. The bubble will prove most useful for reflecting signals in the very high frequency (VHF) band.

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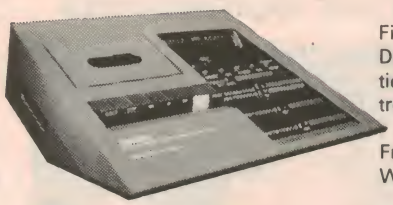

First release of this revolutionary design in Australia. Designed by Mario Bellini. The TC800 gives you facilities like memory, switch for ferri-chrome tape, pitch control and mike mixing.

Freq. response (with chrome tape) 20-16000Hz
Wow & flutter ..... 057% weighted R.M.S.

Pitch control gives ±3% speed change. Signal to noise ratio better than 58dB (high filter on)

CR-600 RECEIVER

The Ideal Centre for Any Medium-Powered Home Stereo System

Direct coupled pure complementary power amplifier/High-sensitivity FM front end with dual-gated MOS type FETs, frequency-linear 4-ganged tuning capacitor/3-stage direct coupled Ic equaliser amp/Low-noise tone controls & filters/Mic mixing/Continuous loudness/ Dual tape deck connections, dubbing circuit/Pre Out-Main In/Relay-operated speaker protectors.

Continuous Output Power (8 ohms, both channels driven, 20-20,000Hz)	30W per channel
Total Harmonic Distortion (rated output)	Less than 0.1% 5-70,000Hz
Power Bandwidth (IHF)	2.0 V
Usable FM Sensitivity (IHF)	75dB
Selectivity (IHF)	
Connections	Aux, Phono (2), Tape Deck (2), Pre-Out, Main In, If Out, Speaker Sets (2), AC (4), Mic, Headphone
Dimensions	474 x 158 x 300mm (18¾" x 6¼" x 11¾")
Weight	13kg (28.7 lbs.)

YP-400 TURNTABLE

Belt-Drive Stereo Turntable with Uncluttered Styling and Top-Line Extras

Smooth Yamaha belt-drive system for lowest wow & flutter/One-touch on-off, speed selector controls/Auto return/Unique double float construction/Universal type plug-in head shell/Precision balance weight system/Auto-cut signal interrupter ends sound of stylus lowering onto record surface.

Wow & Flutter	Less than 0.08%
Signal-Noise Ratio	Over 48dB
Effective Tonearm Length	222mm (8-3/5")
Dimensions	440 x 155 x 383mm (17¼" x 6" x 15")
Weight	8.4kg (18.5 lbs.)

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NEWS HIGHLIGHTS

Philips introduces 20AX colour TV tube

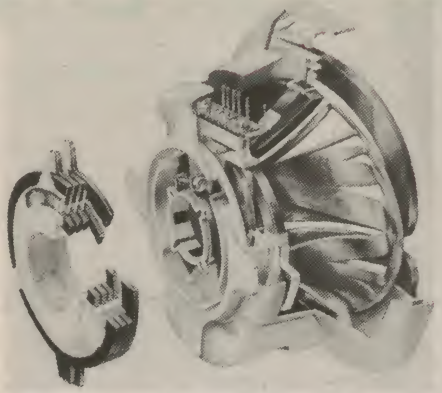
On June 10 Philips Elcoma held a demonstration and technical lecture in Sydney to introduce their new 20AX picture tube and deflection system to the Australian TV industry.

Three picture tubes are being offered, having diagonals of 18, 22 and 26 inches. They feature a vertical slit shadow mask, in-line gun assembly, quick heating (five second) cathodes, and 110° deflection angle.

The heart of the 20AX system is the deflection yoke. This is unique in that it is inherently self-converging, convergence being achieved by the manner in which the yoke is wound. Both vertical and horizontal coils are saddle wound, with the addition of small toroid correction windings.

The system does not employ convergence windings of any kind and, as a result, the picture tube neck is 20 mm shorter than conventional 110° tubes.

The lecturers who described the system emphasised that the self-convergence system is so good that any yoke may be fitted to any tube and, after normal static convergence adjustments have been made, will produce a convergence error of no more than 2 mm on any part of the screen.



Cut-away picture of the 20AX self-converging yoke. The static convergence and purity magnet assembly features gear operated magnet rings.

The lecturers provided a very impressive practical demonstration to back this claim, featuring a 22 inch tube fed with a crosshatch pattern and a 26 inch tube fed with normal program material.

On the basis of this, it appears to be perfectly practical to market a colour TV set having no dynamic convergence circuitry of any kind, a 2mm tolerance being well within current industry tolerances.

Elimination of converence circuitry can save up to 100 components, while the elimination of convergence adjustments means a substantial saving in labour costs.

At the same time the customer gets a convergence standard which is at least as good as, and probably better than, that available in most current designs. He also gets a higher order of reliability by reason of both the reduction in the number of components employed, and the elimination of so many critical adjustments.

For the deluxe set designer, who wishes to improve on these convergence standards, correction circuits can be added. All such corrections are performed via the yoke windings and only a few additional components are required.

Six adjustments can be provided for the 18 and 22in tubes and seven for the 26in. All are essentially "vernier" adjustments and not in any sense critical.

As a further refinement, not all these adjustments need be fitted. Where a cost compromise must be met, the least critical adjustments—which in one case is also one of the more expensive—may be omitted.

Dick Smith donates Icom transceivers to WIA

As part of a program to increase interest in the 2 metre band, Dick Smith Electronics is giving one free Icom IC22A transceiver away for every ten sold. All the transceivers will be donated to a club or a division of the WIA.

The first of the Icom transceivers to be given away was recently handed over to the NSW Division of the WIA. Our picture shows Ted Mills (VK2ZTM), President of the NSW Division of the WIA, receiving the Icom IC22A from Harry Tyreman (VK2BHT/G3SLL), of the Amateur Radio section at Dick Smith Electronics.

The IC22A is a very compact transceiver covering the 146-148MHz band in 22 channels. Output is switchable from 10W to 1W. Receiver sensitivity is 0.4uV, and the front end is equipped with 5 helical resonators. The unit is ideal for repeater or WICEN emergency use.

Purchasers of the new Icom IC22A can nominate the club or division of the WIA they would like the sets to go to. Once ten nominations have been received, a free set is donated to the particular club or division. In all, some ten sets will be given away.

Amateurs wishing to take advantage of this special offer will find full details in "Amateur Radio." Alternatively, further information may be obtained from the Dick Smith Electronics Centre at Gore Hill.

. . . and announces a record turnover

The past year has seen the turnover of Dick Smith Electronics more than doubled, with turnover well in excess of $2 million.

According to Dick Smith, Managing Director, the major contributing factor to the increased sales growth has been the opening of two new stores in Sydney. These are located at Bankstown and in the City, and were opened in June, 1974 and April, 1975 respectively.

The Gore Hill headquarters and mail order department has now reached bursting point, according to Mr Smith. A move to larger premises is currently being negotiated, and this will greatly improve efficiency in the mail order section where service has been slightly delayed lately.

Edge Electrix moves to larger premises

Edge Electrix, well known in Sydney's Western Districts as a wholesale/retail supplier of component parts, recently moved to a larger, more modern premises.

The new premises, at 31 Burwood Road, Burwood, is not more than 10 metres from the previous location. It has a modern showroom which, together with storage facilities, covers nearly 185 square metres. Display frontage is 12 metres.

Mr Bill Edge, founder of the business, is confident of the future. "The space we now have gives us a great deal more scope," he said. "Before, we had to condense our stock because we were confined by limited space. Now with the showroom area we are able to carry a larger selection of our traditional lines, eg component parts, speakers and Hi-Fi. We will also be able to expand into colour TV, with a wider range of Hi-Fi speakers and Hi-Fi gear, plus a large stock of car sound equipment."

Mr Edge was quick to point out that although he was now able to offer a large range of electronic consumer products, his main business is still as a parts supplier. Personalised service will be maintained, although the customer now has the option of selecting his components "supermarket style," thus avoiding any customer queuing at the counter during busy periods.

3 Dimensional

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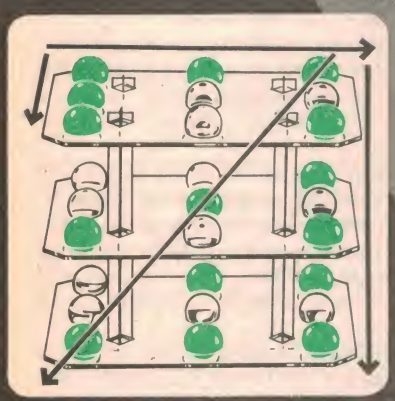

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NEWS HIGHLIGHTS

Electron beams may trigger nuclear explosions

Sandia Laboratories in Albuquerque, New Mexico, reports further progress in creating powerful pulses of electric current for possible use in triggering small thermonuclear explosions to generate electric power.

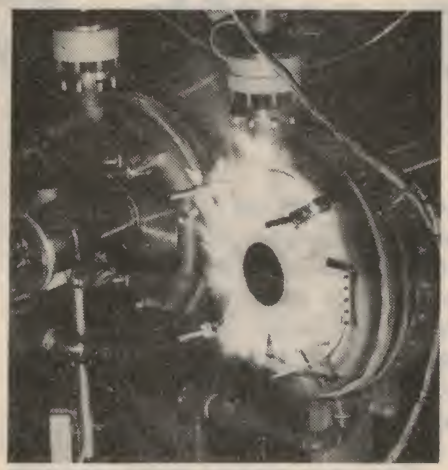
The pulses are actually beams of electrons which are discharged into a vacuum chamber where they can be focused onto BB-size pellets of deuterium and tritium.

Sandia experimenters are now working with machines which produce beams with a power of about one trillion watts. It is presently estimated that to achieve breakeven—energy in the explosion equalling that in the beam—will require approximately 100-trillion watts of power in the beam.

A commercial power plant fuelled by such explosions would require even more energy in the beam, and must be capable of being fired many times per second. Energy released in each pulse would be comparable to that released in the explosion of five pounds of TNT.

A basic problem facing experimenters is how to concentrate beam pulses so that they will be short enough, 10 billionths of a second or less, and small enough in diameter, about 2.5mm, to cause the atomic nuclei in the BB-size pellets of deuterium and tritium to combine, or "fuse."

The pellets would be dropped or fired into the target chamber, where they would be heated and compressed by the beams, thus causing fusion. Deuterium and tritium are heavy forms of hydrogen, and it is the fusion of the nuclei in their atoms which produces thermonuclear energy.



A 350,000 amp, 700,000 volt electron beam creates a spray of molten metal as it strikes an aluminium target plate. The pulsed beam, focussed to approximately 4mm in diameter, lasted just 80nS.

In recent progress, Sandia experimenters have developed switches which they believe will allow the switching of several million volts of electricity in pulses lasting only 20 billionths of a second. These switches work on the principle that an insulating material, such as gas or oil, breaks down abruptly, closing a circuit so that the electric charge flows from one point to another.

In the past two years, the scientists have also discovered and improved an approach to focus the beams down to the diameter of the pellets. This involves creating a region of plasma or ionized gas near the pellet. The plasma keeps the electrons from electrostatically repelling each other, thus enabling magnetic forces in the beam to focus it to the proper diameter.

Recent experiments indicate that the beams are gas-like in nature and, when directed against a target, tend to bathe the surface evenly. Experiments in which the beams from one of the Labs' large accelerators are directed from opposite sides onto a spherical pellet are now being conducted.

The next major step in two-beam testing will be on the Labs' Harp accelerator, which will be ready for its first tests this year. Harp will provide two 500,000-amp beams for 25 billionths of a second. Total power will be about 2 trillion watts. Large accelerators are being designed and considered for future studies.

Sandia Laboratories is an Atomic Energy Commission prime contractor engaged principally in research and development on nuclear ordnance.

—George E. Toles.

Ethnic radio station

Following a request by the Australian Government, Amalgamated Wireless (Australasia) Ltd recently established an experimental radio station in Ashfield, Sydney, to broadcast to ethnic communities.

Considered Australia's first ethnic radio station, the new station is the result of a project inaugurated from the Office of Community Relations headed by Mr A. J. Grassby, the Government's special adviser on community relations. Operations commenced on June 9 for an experimental period of twelve weeks. Broadcasts are in seven languages for a period of six hours each day.

When the Government decided to set up the station, it selected Ashfield as the best centre for such broadcasts because of the concentration of ethnic groups in the area. As AWA has its largest manufacturing works at Ashfield, the Government asked if the company would be prepared to establish and operate the station at its premises for an experimental period.

The station, which comprises a low power transmitter with a limited transmitting aerial situated on the front lawn of AWA's Ashfield factory, was erected and commissioned in less than two weeks after receiving the order. For technical reasons, it has been necessary to ensure that the programs are heard only in an area within 16 km of Ashfield.

Professional institution

Rapid advances in the science of biomedical engineering in recent years has resulted in the formation of another professional institution in Australia—The Institution of Biomedical Engineering (Australia). Formed by senior practising biomedical engineers, the new institution's main aims are to promote the science and practice of biomedical engineering, and to safeguard and promote the interests of its members.

Membership to the institution is available to all properly qualified and experienced biomedical engineers, subject to certain requirements. Inquiries should be directed to The Secretary, The Institution of Biomedical Engineering (Australia), 35 Scarlet Ash Drive, Lower Templestowe, Victoria 3107.

High efficiency solar cell

Research scientists at NASA's Jet Propulsion Laboratory, Pasadena, California, have developed a new type of solar cell which exhibits an efficiency greater than that exhibited by the average silicon solar cell now in standard use.

According to Dr Richard Stirn, the project team leader, some samples of the new cell—called AMOS, for Anti-reflection Coated Metal-Oxide-Semiconductor—have demonstrated an efficiency of about 15 percent in terrestrial sunlight. Further research is required, however, to obtain controlled production at this high efficiency.

The cell is made from oxidised gallium arsenide with an extremely thin, nearly transparent gold film on its surface. Recent tests have shown that it offers superior resistance to radiation when compared to silicon cells and, as such, should have a longer lifetime in space.

In addition, the device may have potential terrestrial solar energy applications. Dr Stirn says that the technology is potentially adaptable to very low cost polycrystalline thin films, with only a modest reduction in efficiency.

Observatory aims for the stars with Cosmos

The commissioning of the latest generation of optical telescopes, such as the 1.2 metre Schmidt telescope at Siding Spring, NSW, confronted astronomers with a new problem—that of analysing the mass of high quality data such telescopes are capable of generating. British astronomers at the Royal Observatory in Edinburgh have tackled the problem by developing a new analytical technique called "Cosmos." In spite of its few short operational months, the Cosmos technique has already produced one interesting new discovery.

Astronomers are well known for talking nonchalantly of numbers that boggle the average mind. But at Edinburgh's Royal Observatory even the Astronomer Royal for Scotland is using superlatives to describe a machine, currently just being commissioned, which will put Edinburgh in the front rank of optical astronomy.

The machine is called Cosmos—for Co-Ordinates, Size, Magnitude, Orientation, Shape—and has been developed to analyse the mass of information on distant galaxies and single stars that the latest generation of optical telescopes is producing. Specifically, it has been designed with Britain's 1.2 metre Schmidt telescope, now operational in Australia, in mind.

Reprinted from "Computer Weekly," London, by arrangement.

The output of the Schmidt telescope comes in the form of photographic plates, 35.5 cm square or less, containing the images of innumerable faint galaxies hundreds of millions of light years away from our own, as well as the images of nearer single stars. Cosmos's job is, in the first instance, to differentiate between stars and galaxies, and then to measure the parameters in its name for any particular images under study. The scale of this undertaking can be judged by the fact that there will frequently be several million images detectable on each photographic plate.

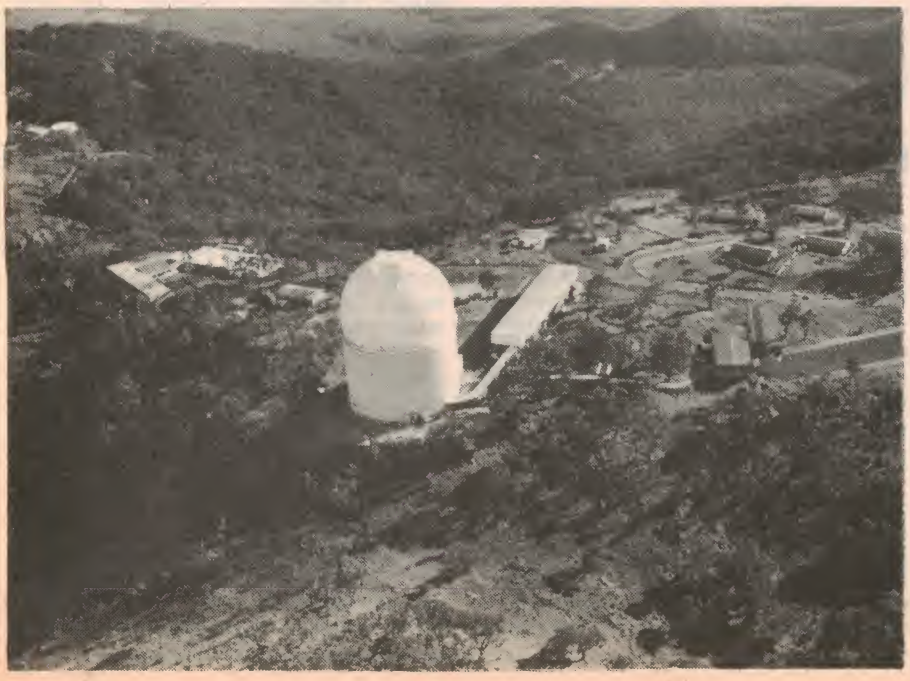
The solution adopted by the Royal Observatory was to build a massively solid table on which the plates are mounted, with a CRT-generated light spot suspended above and a scanner directly beneath to detect the light density as well as the size and shape of the images projected. The whole machine, accurate to within half a micron (the average human hair is 75 microns wide), is controlled in every respect by an 8K Honeywell 316 processor. All the operator has to do is change the plates from time to time and, rather more often, the magnetic tapes on to which Cosmos writes its findings.

Although the principle by which Cosmos operates is not new, the machine, in tandem with the Schmidt telescope, represents a quantum step forward in the data available from optical astronomy. Whereas previous systems could make Cosmos-type measurements (rather slowly) for individual stars, Cosmos itself extends this capability to whole galaxies for the first time. Previously such work as was done on distant galaxies was performed manually, the photographic plates from telescopes being examined in minute detail under powerful microscopes.

Some indication of Cosmos's potential can be derived from the knowledge that it had analysed more in its first operational hour than Dr V. C. Reddish, the scientist in charge of the project, had managed to do manually in six months.

The machine has three operational modes. The first, called "Coarse Measurement", is designed for a rapid once-over of all or part of a particular plate. Using the Y axis of the carriage, and with the scan set at either eight, 16 or 32 microns, Cosmos records the positions of all the images it detects at up to 4,000 a second. The time required to measure a whole plate depends, obviously, on the resolution selected—18 hours at eight microns, five hours at 16 and just an hour and a half at 32.

In the second mode, known simply as "Mapping", the machine outputs a single character representing the measure of the transmission of the plate at each eight-micron interval to an accuracy of one percent. Although this is a far more detailed operation, the speed is the same as for the eight-micron operation in "Coarse Measurement". In fact, the mode is used for detailed analyses of information from selected portions of a



At left, an aerial view of the new 3.9 metre Anglo-Australian Telescope at Siding Spring Observatory, NSW. The 1.2 metre Schmidt telescope is also located here.

plate—data generated by the whole of one plate in this mode would fill 200 magnetic tapes.

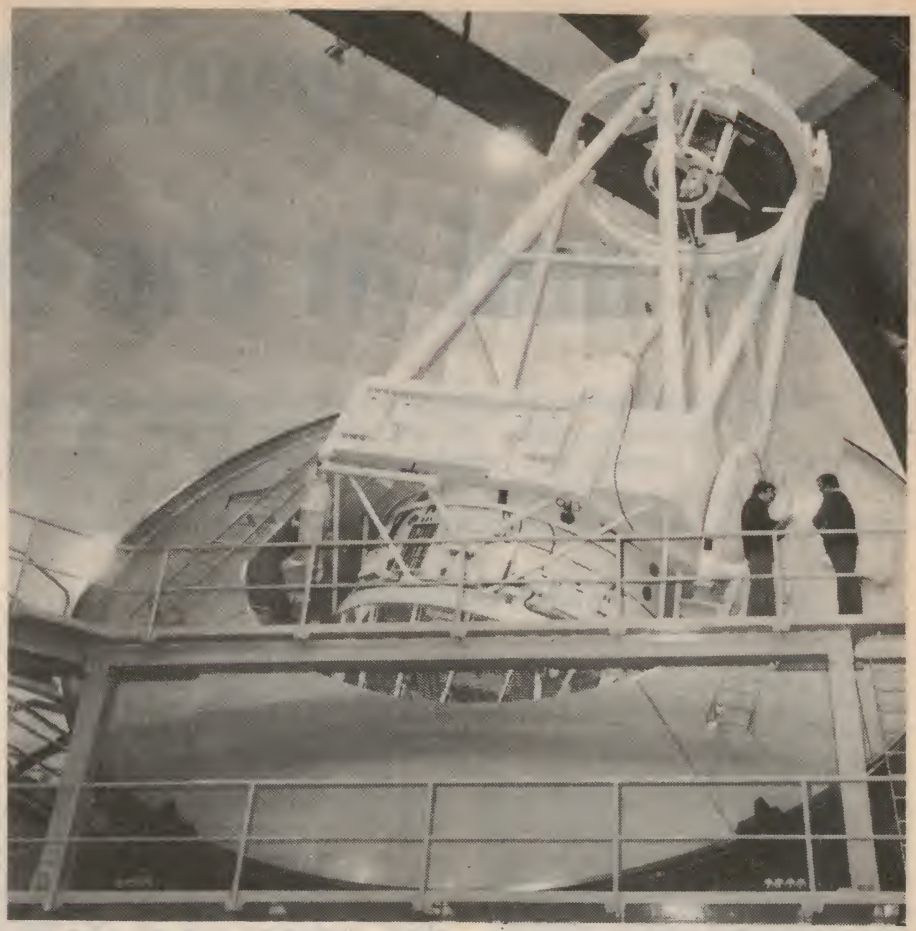
At the time of writing, the third mode was not fully operational, but was expected to be so by the time the Observatory started signing up Cosmos users (chiefly universities and other observatories), probably by the end of last April. It is called "Fine Measurement", and involves the input on paper tape of the co-ordinates of a specific image for which greater information is required. The image is then centred with great accuracy, and its ellipticity, orientation and magnitude are determined.

The magnetic tapes generated by the machine (using an Ampex drive) are later fed into an ICL 1906A at the Atlas Laboratory, in Chilton, før analysis. The output is a variety of graphical and mathematical forms, including the new colour graphics capability of the laboratory. At the moment the volume of data is irregular and quite small, but the vast amounts of information which Cosmos will be generating when it is running 24 hours a day, seven days a week have raised doubts as to whether the 1906A is adequate for the job.

Staff at the Royal Observatory in Edinburgh make no secret of the fact that they would rather have the use of an IBM 370/195 or a CDC 7600, but they have no choice but to use the 1906A, since the whole project is funded by the Science Research Council. They look forward, however, to the projected link between the Atlas Laboratory and the Rutherford's 195, and in the longer term to the replacement of the 1906A itself. In the short term they would prefer to have some graphics capability, and preferably colour graphics, attached to the Modular One which is used for, in fact virtually dedicated to, the Cosmos remote job entry link with Chilton.

The Honeywell 316 which controls the Cosmos machine itself was programmed in DAP-16 by Mr R. Martin of the Observatory; it took him about two years, which was also the hardware development time. He points out that there is nothing so special about the application that it need be used only for astronomical purposes, and discloses that the Observatory has already had some inquiries from quite non-astronomical sources as to the availability of Cosmos for other high-accuracy detection and measurement applications. However, astronomical work is likely to fill all the available time on the machine in the near future.

Although Cosmos has only been run for a few hours so far, a find has been made that Dr Reddish, with characteristic astronomers' casualness, calls "rather interesting." This is that there are twice as many galaxies in the local area of space around our own than might be expected on the basis of what is known of galaxy "clustering" elsewhere in the universe. To put it another way, the increase in numbers of galaxies you would expect to find as the volume of galaxies detected increased, i.e., as you get further away from earth, is irregular — it increases at a much lower rate beyond about 500 million light years. This is something that only the prodigious galaxy-counting capabilities of Cosmos has been able to disclose.



A general view of the "works" of the new 3.9 metre Anglo-Australian Telescope at Siding Spring Observatory, one of the most technologically advanced optical instruments in the world. Presumably, it also lends itself to COSMOS analysis.

It had previously been assumed that the numbers of galaxies increased in proportion to increases in volume, no matter what part of the universe was being studied. However, the new discovery means that we are living in what Dr Reddish terms a "supercluster" of galaxies, and this raises a host of new questions about the evolution of the universe — questions that Cosmos will have to try to answer.

Dr Reddish concedes that, in terms of sheer distance, radio-astronomy still has a fair edge on optical. But he believes that the advent of Cosmos, coupled with the advances in optics and photographic technology that are embodied in the Schmidt telescope, will draw the two branches of the science much closer together. Preliminary comparisons of radio-astronomical findings with those generated by Cosmos have shown that at least 40 percent of radio sources can be readily identified with their visual equivalents. Dr Reddish believes that this proportion will be raised to nearly 70 percent when the system becomes fully operational.

All this has been achieved at remarkably little cost. Although a customer buying a Cosmos from scratch would now pay about £250,000 for it, the Observatory's direct costs were only in the region of £70,000 — the rest being accounted for by the considerable effort put in on the system's development by the Observatory's own staff.

A visit to the Royal Observatory in Edinburgh suggests that the astronomers now working with Cosmos — to say nothing of the computer specialists from Heriot-Watt University's computer applications service, which developed the system for the Observatory — are somewhat in awe of the machine's potential. "We knew we would be getting vast amounts of data," says one, "but it's the quality of the information that's really exciting."

All the Observatory's scientists agree that Cosmos heralds a new era in our understanding of the forces that govern the development of the universe. As Professor H. A. Brück, retiring Astronomer-Royal for Scotland, says: "Cosmos will enable British astronomers to extend their work from galactic to extra-galactic astronomy for the first time."

Robot technology— now and in the future

By the 1980s, the existence of highly automatic, self-reproducing robot factories may become a reality. In fact, there are already powerful economic forces pushing the introduction of robots in an effort to increase productivity and reduce costs. Here we take a look at the status of robots today, and examine their potential for tomorrow.

by JOHN M. EVANS Jr and JAMES S. ALBUS*

The near future holds the promise of manufacturing industries based on integrated systems of robots and automatic machinery.

This is not science fiction; robots are already working in industries at hazardous or unpleasant tasks. Between 1,500 and 2,000 robots are in worldwide use today in such jobs as loading and unloading die casting machines, punch presses and forging machines; spray painting; and spot welding. These machines, even if somewhat limited in what they can do, are already reliable and cost effective in a working manufacturing environment.

By the 1980s robots will be available with sensors and computer control systems that will allow them to adapt to changing conditions in their environments, thus enabling them to carry out productive tasks, such as: loading and unloading of machine tools and assembling final products; completing oil wells at depths beyond which divers can operate; mining and tunneling; and other dangerous and undesirable tasks. The technology needed to build such robots is already here or is being developed in laboratories around the world.

The simplest robots are "put and place" mechanisms with only a few degrees of freedom, suitable for part handling or assembly and simple machine loading and unloading. Such simple machines usually have pneumatic actuators and mechanical stops for position control. The sequence of operations of the robot is controlled by a pneumatic or electrical plugboard.

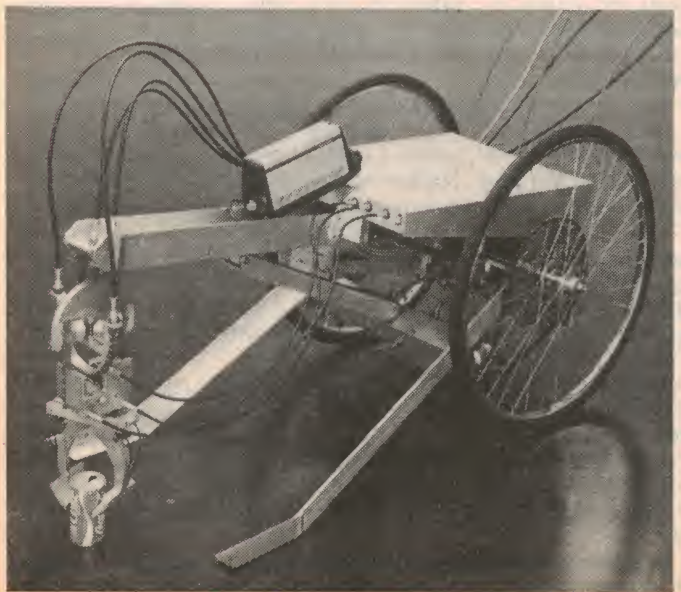
Each row of the plugboard represents one direction of motion of one joint, with each column representing one program step. Diodes or pneumatic lines are inserted in appropriate rows to determine which joints are activated, and in which direction, for each program step. When a joint is activated it is run wide open to the limit of the mechanical stop. These stops can be repositioned when a program is changed. Sequencing of program steps can be by fixed timing or external interlock with other machines.

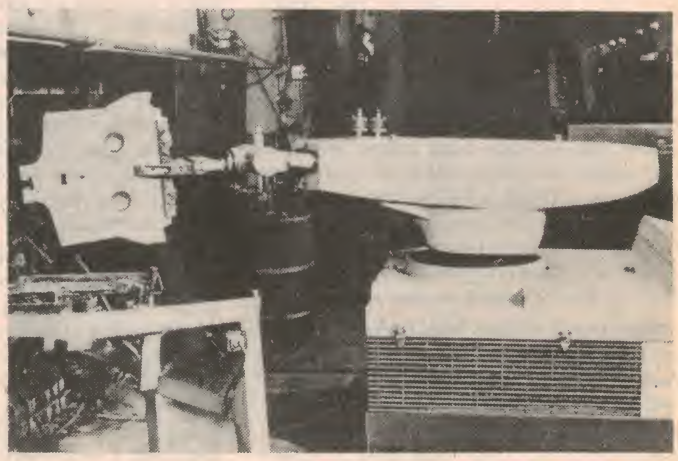
A higher level of sophistication is obtained by adding a position control circuit to each joint. This requires feedback on the position of each joint, which is accomplished by potentiometers, encoders or resolvers.

The simplest way of programming such a system is the potentiometer board, which is similar in conception to plugboard controls, with one row for each joint and one column for each program step. With this system, however, the position of a joint for a given step is determined by the value set on the potentiometer rather than a mechanical stop. Thus a given joint can be moved to any number of different locations in subsequent steps, which is not possible with the simpler robots.

Another type of robot, which has accounted for the majority of sales in the United States, uses digital servos and has a plated wire memory. Programming is accomplished through a hand controller that has a rate control button for each joint. Using the rate control switches, the robot is guided to the desired position and a "record" button is pushed, storing the position of each joint. In playing back

*Dr Evans is acting manager of the Office of Developmental Automation and Control Technology at the US National Bureau of Standards. Dr Albus is a project manager within the same group.





At left, a low-cost mobile robot built by NBS for the US Navy to prove the feasibility of using low-cost, readily available components in robot construction. Above, a "Unimate" robot extracts a part from a clearing press. Industrial robots of this type are suitable for many hazardous or routine jobs.

the program, the control system carries out point-to-point servoing for all joints simultaneously for each step. Fixed timing, completion of the last step, or external interlock may be used to determine the advance to the next step.

This robot may have several programs stored in its memory and will select one depending upon external commands or sensors. For example, robots of this type have been used for spot welding operations on two different models in an automobile assembly line.

Still more advanced robots use continuous trajectory programming. This is not actually a continuous trajectory but rather a trajectory sampled at closely spaced points. Location of the joints at equal increments of time are recorded on tape or in a computer memory as the robot is led through the desired motions. Point-to-point servoing is still taking place when the program is played back, but the points are spaced so close together that a smooth coordinated motion of all the joints is obtained.

This developmental hand or end effector incorporates arrays of tactile sensors in the "fingers," together with torque and force sensors in the "wrist."

These are the robots and control systems of today. In the very near future, however, robots will be available with expanded capabilities through the addition of simple sensors and computer control systems. These additional capabilities will make robots easier to program and will allow the robots to adapt to changing conditions in a partially unconstrained environment.

The use of touch, force and proximity sensors is being explored at several laboratories, and significant experiments have been conducted to demonstrate the increased capability possible with the addition of these sensors. For example, the Artificial Intelligence Project at Stanford University achieved the assembly of a water pump using only touch sensors on a computer controlled manipulator. The Draper Lab at the Massachusetts Institute of Technology has shown how a manipulator with force sensing can follow surfaces or edges, and can insert pins into holes with very tight tolerances.

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A great deal of research has gone into general vision systems for robots and during the 1980s such complex sensors will be in use with manufacturing robots.

The general problem of automatic control of machines may be structured as a hierarchy of control functions, with each level of control calling up ordered sequences of operations at the next lower level (much like a computer program implementing a subroutine) using appropriate sensory feedback for each level. Man may enter the control hierarchy at any level for direct control or for programming the robot system for later playback. The basic concept is that man will program the robot in high-level task-oriented commands, and the computer will break these down into a series of elemental motor actuator signals.

The NBS Automation Technology Program has been investigating one particular approach to such high level control structures for manipulators that promises to be both very powerful and very inexpensive. The Cerebellar Model Articulation Control (CMAC) system is a general purpose adaptive control system that can handle any kind of feedback variable such as misalignment of parts, variable mass loading, irregularities in materials, and other constraints imposed by the external environment. All that is needed is appropriate sensors to tell the computer what is happening in the system being controlled.

Control functions may be represented in the form of equations, or may be stored as numbers in a table in a computer memory. CMAC uses form of table look-up of control functions. Control commands and sensory feedback essentially define a memory address, with the contents of that location in memory being the value of drive voltages for a motor or a servo valve.

This technique of storing control functions numerically has generally been considered impractical because of the large amount of memory thought to be required. However, CMAC uses a form of addressing and data storage that allows control functions for real problems to be stored in a computer memory that is small enough to be economically feasible. CMAC may be implemented on very small computers, even microprocessors, and is useful in any case where control functions are difficult to define analytically, such as when there is a great deal of sensory feedback to be processed.

CMAC is, of course, only one approach to implementing higher level control and has yet to be proven in practical applications. The use of table driven control systems with interpolation capability does appear to be a very powerful general concept, however, and should allow the development of robots that will be both sophisticated and inexpensive.

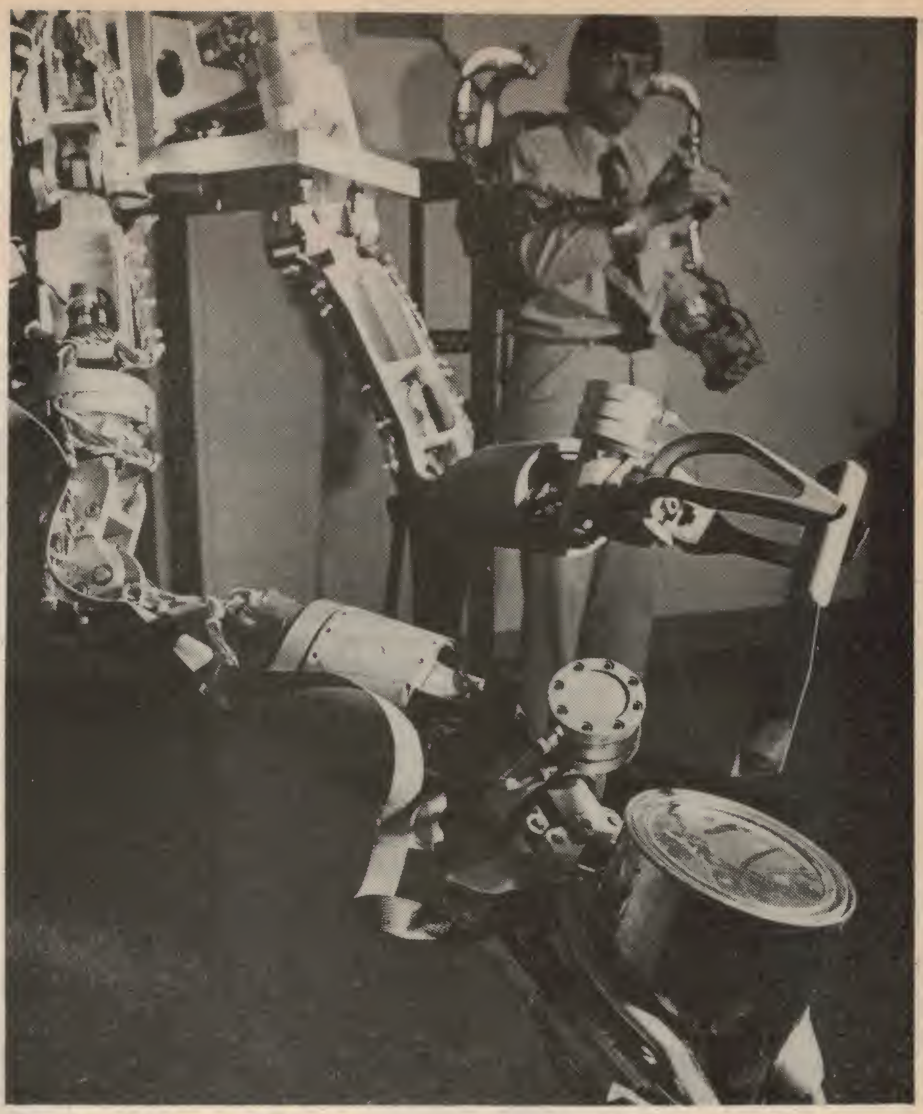
We have focused primarily on one aspect of automation in this article, the control and use of robots in manufacturing. The same basic technology is applicable to controlling all kinds of machines for service sector applications as well as for manufacturing. For example, there are now computers built into cash registers (point of sale terminals), cars can be plugged into computers for diagnosis of their problems and computers have even entered the entertainment field, controlling ping pong and other games played on a TV screen.

Airline autopilots, automated clinical analysis and automated garbage collection systems are further examples of applying automation in the service sector to increase productivity and to improve working conditions for man.

The development of the technology for advanced robots with sensors and computer control systems appears straightforward; there seems to be no major technical barriers to achieving highly automatic, self-reproducing robot factories in the 1980s. In fact, there are already powerful economic forces pushing the introduction of robots to increase productivity and reduce costs. Obviously, there will always be some people around to cope with emergency situations, breakdowns and with initial programming. However, the number of people actually operating machine tools may be reduced significantly.

The real problems in achieving automatic factories will thus be economic, social and political. If the robots do the economically productive work, how do people receive any income? And, just as important, if robots are to create most of the material wealth in our society, who will own them and control the powerful economic and political forces they will represent?

These problems must be faced along with the technical problems if any country is to obtain the increased wealth and leisure time that appear possible when robots are widely applied in manufacturing and service tasks in the next few decades.



Dr John M. Evans Jr, NBS computer scientist, wears a computerised harness to direct by remote control the movements of a robot in performing manual tasks.

Reprinted from "Dimensions", by arrangement with the US National Bureau of Standards.

RF front end for FM stereo tuners

Last month we described an FM IF and decoder subsystem, and as promised we now present a matching "Front End". When integrated, these two parts make a complete high quality FM stereo tuner.

by IAN POGSON

Before proceeding, it may be wise to point out that although FM tuner front ends are quite small, with relatively few parts, they are not as easy to get going as IF and decoder systems. Every care has been taken in producing and presenting this front end so as to make duplication as easy as possible. Provided readers follow the instructions carefully, the chances of success are very high. For readers who are inexperienced and are hesitant to tackle this part of the project, we suggest that they would be wise not to attempt it.

There are a number of important FM tuner front ends on the market. For readers who would prefer to use a ready made front end, we hope to investigate these later on.

The front end which we have developed is fairly basic. It has been derived from the one described in Wireless World in April 1971, although comparison will still reveal quite a number of differences. Physically, ours in quite different, in that we have laid out a printed board for it and one which is physically and electrically compatible with a locally available tuning gang. This and other reasons dictated that some of the circuitry be modified to suit our purpose and conditions.

The output circuit, which is the mixer load, has been reduced to its simplest form. A 330 ohm resistor functions as the load and meets the source impedence requirement of the ceramic filter which follows. The use of this resistor ensures stability of this part of the circuit but at the same time, the overall gain of the front end is somewhat reduced. The loss of gain has been made up in the following amplifier and the benefit of obtaining stability makes this approach attractive to home builders.

Reference to the circuit diagram will reveal that it consists basically of an RF amplifier, a mixer and tunable local ocillator.

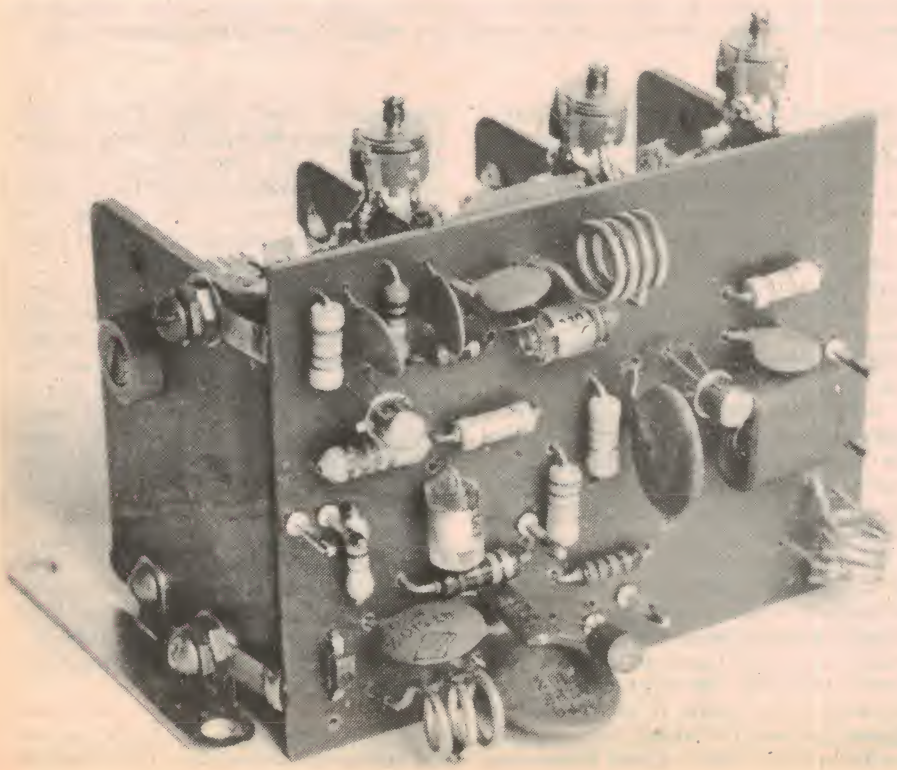
The aerial input provides for either a balanced or an unbalanced system. This is achieved by the use of a "balun" transformer coupling into the first tuned circuit, the input of which is designed for a nominal 75 ohm coaxial cable. By bringing out suitable terminals, either a 300 ohm balanced, or a 75 ohm unbalanced feeder may be used.

The tuned circuit at signal frequency which follows consists of an "air wound" coil tuned with one section of a 40pF tuning gang. A tap on the coil feeds the signal to the first gate of a dual gate MOSFET. A stopper in the form of a coil tuning slug is included in the lead to the gate to ensure stability.

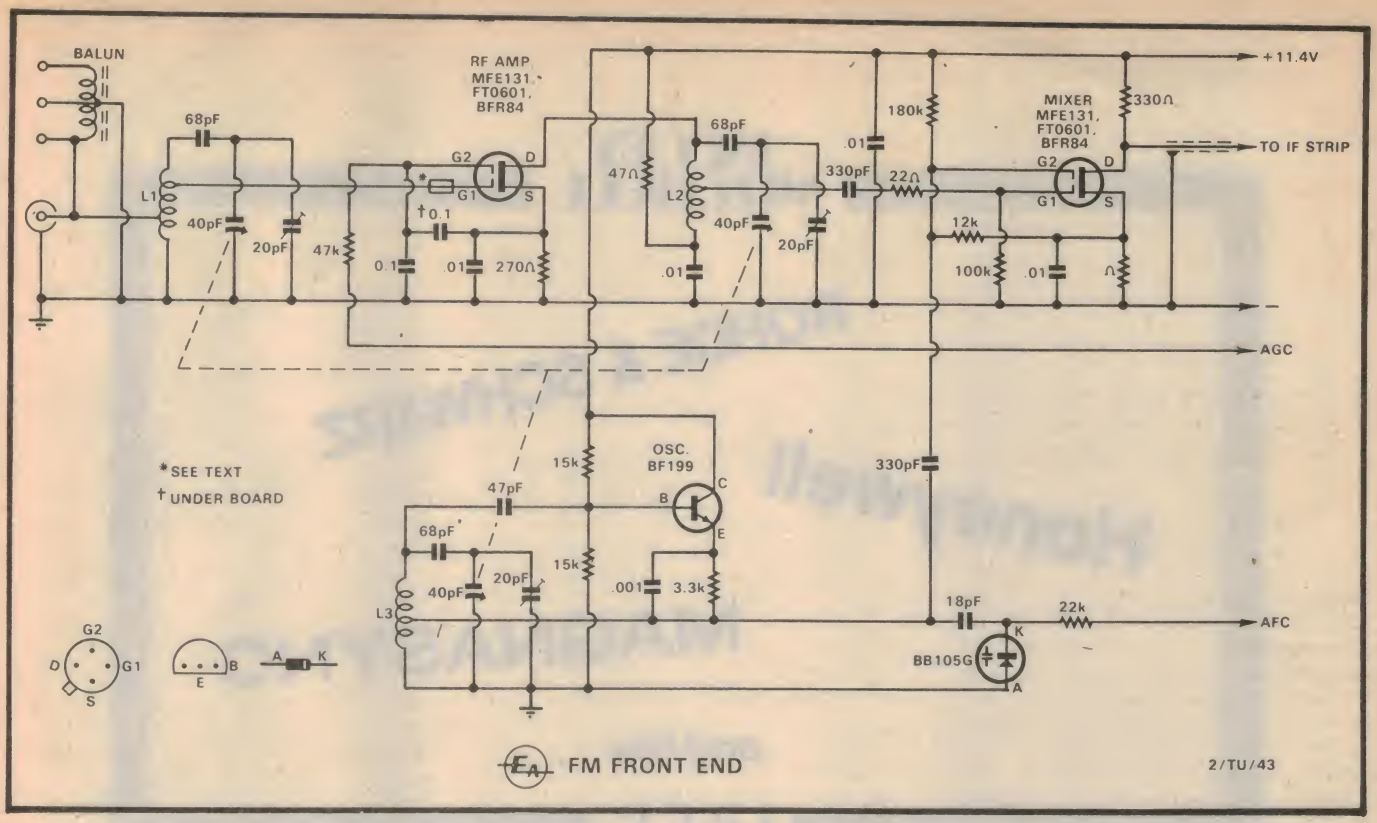
There are three bypass capacitors, one each on the second gate and across the 270 ohm source bias resistor, and one from the second gate to the source. AGC from the IF system is fed to the second gate via a 47k resistor. In the drain of the same stage is another tuned circuit at signal frequency, similar to that on the input side.

The signal is taken from a tap on the coil to the first gate of the mixer, another dual gate MOSFET. A stopper is used in the first gate, this time a 22 ohm resistor. The 270 ohm source resistor is bypassed but the second gate is not bypassed. Instead, it is biased with a resistive network and injection is fed to it from the local oscillator, via a 330pF capacitor. We note that some builders of the Wireless World version of this tuner ran into an instability problem which was cured by adding a ferrite bead in series with one lead of the 330pF capacitor. We have not found this to be necessary but some readers may not be as lucky.

As mentioned earlier, the drain load is a 330 ohm resistor and the 10.7MHz IF emerging from this point is fed into the IF system which was described last month.



At left is the completed FM front end sub-assembly. See text regarding balun transformer.



FM FRONT END 2/TU/43

The ocillator uses the familiar Hartley configuration, with a BF199 transistor; it tunes at a frequency 10.7MHz above the frequency of the incoming signal. In common with the aerial and RF coils, the oscillator is also wound "on air". Automatic frequency control (AFC) is achieved by varying a DC reverse voltage across a type BB105G diode, in series with an 18pF capacitor. The diode and 18pF capacitor are connected across part of the oscillator tuned circuit. Any frequency drift causes a change in voltage to be produced in the detector IC and this change in voltage restores the oscillator to the correct frequency.

In all three tuned circuits there is a 68pF NPO ceramic capacitor in series with a section of the tuning gang. The reason for them is that the gang has a capacitance of 40pF per section and this was more than enough to tune the 20MHz of the FM broadcast band. The "padder" of the above value brought the tuning range right, together with the 20pF trimmers in each circuit.

While we are still on the subject of circuit details, we have already mentioned "stoppers" for stabilising purposes in the first gate of the RF amplifier and the mixer. In the RF amplifier, we used a Neosid grade 900 coil tuning slug. The one we used has a hexagonal bore about 6mm in diameter and is about 10mm long. The lead between the coil tap and the gate is a piece of tinned copper wire and the slug was slid over the lead. The 10mm long slug may not be easy to get but an alternative is one which is 12mm long and this one may be shortened by snipping the excess off with a pair of cutters.

Instead of using one of the slugs just mentioned, a ferrite bead, type FX1115 may be substituted. Also, in some cases, instead of any of the foregoing, a 22 ohm resistor may be used.

As already mentioned, the stopper in the gate of the mixer is a 22 ohm resistor. Although we have found this to do the job, any of the alternatives as described for the RF amplifier stopper may be used.

So much for the circuit details. Some comments on components used may help to clarify a point or two. The aerial input balun transformer may be a standard TV balun ready wound, or you may wind your own. The transformer is wound on a Neosid type 1050/1/F14 core and these are readily available.

The 3-gang tuning capacitor is one which has been specially made for this project by Roblan and distributed by Watkin Wynne Pty Ltd of 32 Falcon Street, Crows Nest, NSW 2065. Supplies should be available by the time this appears in print, from your local supplier. It may be noted that this gang is actually two separate 3-gang units in the one assembly. The low capacitance sections are used in the front end being described, while the high capacitance sections will be used in an AM tuner, to be integrated with the FM tuner.

The printed circuit board, coded 75FE5, measures 76mm x 58mm is being made by RCS Radio and possibly by other manufacturers, and this item should also be available through your local supplier.

The dual gate MOSFETs which were used are type MFE131, made by Motorola. We also tried the Fairchild type FT0601, which was quite satisfactory. Philips have a near equivalent type BFR84, which should also be satisfactory. The oscillator uses a bipolar transistor type BF199, which is a Philips VHF type in the economy price range. We suggest that you use this type unless you have any definite ideas to the contrary. Incidentally, we tried the trusty BF115 but it was not a reliable performer at the frequencies of interest.

There are a number of variable capacitance diodes which may be considered for the AFC function. However, after careful consideration, we chose the Philips BB105G as being the most suitable for this particular application. It is an economy version of the BB105 series and it performs the funtion very well.

All fixed capacitors below 100pF should preferably be NPO ceramic types. An alternative where this type is not readily available would be the polystrene range. No trouble should be experienced in getting suitable 330pF units. All the higher values used for bypassing should be ceramics.

The complete assembly consists of two major sub-assemblies. These two sub-assemblies are the printed circuit board with its components, and the composite 3-gang tuning capacitor, with trimmers. In order to keep lead lengths of the VHF circuits to a minimum, we have already fixed the printed circuit board to one side of the gang.

It is always a good idea to wind coils and prepare any other small items before going ahead with assembling the printed board, etc. Details for winding the balun transformer are given in the individual circuit for it, together with a corresponding coded drawing. To do one winding,

FM front end

take a piece of 20B&S enamelled copper wire about 300mm long and fold it back on itself from the centre. Now make a bilifar winding of 2½ turns through one of the slots. Repeat the process for the other slot, using a second piece of wire. Identify the ends of each of the windings according to the circuit and connect them as shown.

The three coils L1, L2 and L3 are shown in the drawing. The dimensions given, particularly the lengths, are a starting point and will need to be adjusted on alignment. The ends and taps of the coils should be such that the coils may be mounted with about 3 mm clearance from the board for L2 and L3. In the prototype, we found that it was necessary to squeeze L1 down much shorter than the original length and to offset the need for this, we suggest that you make the leads on L1 so that it may be mounted with about 4 to 5 mm clearance from the board.

L1, L2 and L3 are wound with 18B&S tinned copper wire. The wire should be slightly stretched by holding one end in a vice before winding. Each one is wound on a 7mm rod or drill and tentatively finished to the dimensions shown. The taps are made with 22B&S tinned copper wire and care should be taken to make sure that the taps are accurately placed.

The board is assembled as shown in the diagram and the photograph. As always, care should be taken to make good soldered joints without overheating any of the components. Make sure that the transistors are terminated correctly and it is also important to be sure that the coils are mounted in each respective place and that the taps are correct.

Since the photographs were taken of the front end, there have been a couple of minor changes. A balun transformer is shown mounted on the board but we have chosen since to remove it and put the balun on the back panel of the overall tuner assembly, adjacent to the two aerial terminals. This seems a better arrangement but for readers who may wish to do so, there is no reason why the transformer should not be mounted on the printed board in the original position.

The other point relates to the stopper in the gate of the RF amplifier. A 22 ohm resistor is shown in the picture but we have since changed it to the grade 900 coil slug mentioned earlier.

Having finished the board from the top, do not forget the items to be mounted underneath the board. Apart from the 0.1uF bypass capacitor, the three 68pF ceramics must be mounted so that they constitute the leads from the coils to the respective sections of the tuning gang.

With the board now fully assembled, the next job is to fix it to the side of the gang. From the picture it may be seen that at one end we have screwed two large solder lugs to the body of the gang. The same arrangement applies for the other end as well. You may also notice that there are a couple of nuts under each screw head. These have been added to effectively shorten the screw so that it will not foul active parts of the gang. A neater way would be to cut off the screws to the required length.

With the four lugs in place and with the gang sitting on a flat surface, offer the board up to the lugs, with the bottom edge of the board resting on the same surface as the gang. Carefully solder the lugs to the earth copper of the board. Now terminate each of the three 68pF capacitors to its respective lug on the gang. Three trimmers also have to be soldered to the gang. Before attempting this, the area on the gang body to accept the trimmer rotors should be properly tinned. Soldering the trimmer in place is then quite easy.

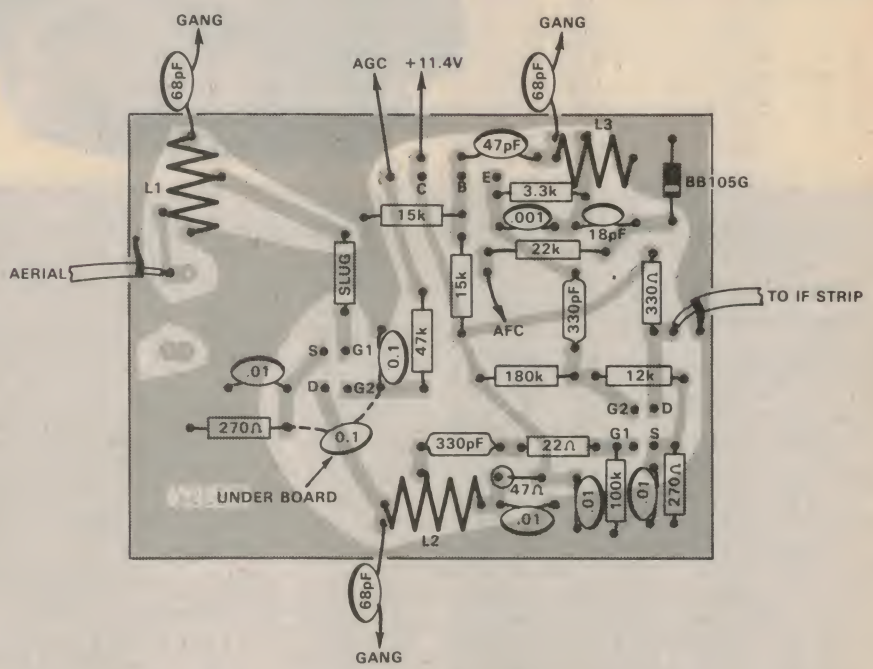
Connecting the ends of the gang body to the earth copper of the board is not sufficient when dealing with VHF, and steps must be taken to shorten the earth paths. In this case, it is sufficient to connect each of the two shield panels of the gang directly to the copper on the board, with a short piece of tinned copper wire. This can be conveniently done on the top of the gang, with leads no more than 10mm long. Do not forget these links as their omission could lead to instability.

The front end will ultimately be mounted adjacent to the FM IF board and the ultimate plan is to accommodate the front end on the same board as the AM tuner and power supply for the complete system. Meanwhile, if you wish to adjust the front end, or if you do not intend to add the AM tuner at all, then it will be necessary to provide a piece of copper laminate, 127mm x 76mm, to which the front end will be fixed.

With the front end fixed to its board, the whole assembly should now be connected to the FM IF board. Screw two solder lugs to the two holes of the IF board, butt the two boards together and solder the lugs to the base board of the front end. A couple of extra connections should also be made at intermediate points. Take two pieces of tinned copper wire about 10mm long and use them to effect a soldered connection in each case.

At this stage, we are ready to electrically connect the two units to form a complete FM tuner. Interconnections to be made with hookup wire are the +12V supply, AGC and AFC. A light piece of coax cable is used to connect the IF output from the front end to the input of the IF strip. It is earthed at both ends, connection at the IF board end being effected by means of a solder lug under the adjacent screw. The lead from the aerial tap on L1 to the balun transformer will also be run in the same type of coax cable.

Construction of the FM tuner is now complete and we will assume that you have already adjusted the IF board. To adjust the front end, the same supply of 12V which was used previously will be required again. At this stage, in the absence of a calibrated dial scale, it will be necessary to use an FM signal generator for adjustment and alignment. Later on, when the whole unit is assembled with its dial assembly and with a calibra-



This component layout shows the PC board from the component side. Circuit board pins are used to facilitate external connections. Pattern is shown actual size.

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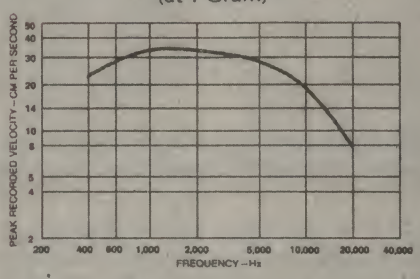
- 19 CM/SEC at 10,000 Hz

Tracking Force: ¾ to 1½ grams

Frequency Response: 20 to 20,000 Hz

TRACKABILITY CHART
(at 1 Gram)



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ted scale available, it will be possible in most cases to make all the necessary adjustments without a generator, using available FM signals, including those from TV transmissions.

To carry out the alignment, connect the 12V supply. Set the three trimmers to about three quarters of full mesh, and connect the generator to the tap on L1 via a .001uF ceramic capacitor. We will assume that the signal strength meter is connected to the IF board and that the audio output from the IF board is connected either to an audio amplifier or a CRO.

With the gang fully meshed, search around 88MHz with the generator until a signal is heard. It may be necessary at this stage to use a fairly high level from the generator. Having found the signal, if it is below 88MHz, L3 will need to be stretched in length slightly, until the correct frequency is obtained. If however, the frequency is above 88MHz, it will be necessary to squeeze L3 to shorten it to obtain the correct reading.

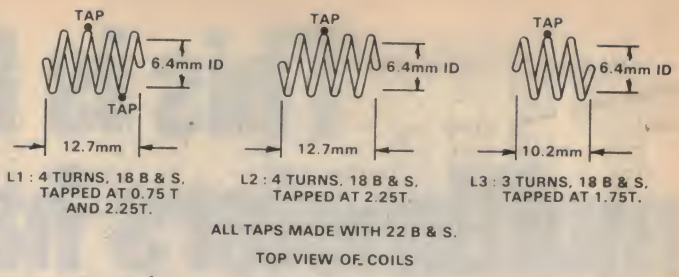
To check L1 and L2 you will need a "wand". This is a short piece of insulating material about 80 mm long. To one end fix a coil slug of iron dust or ferrite, and to the other end fix a piece of about ¼in diameter brass rod, about the same size as the slug. Insulate the brass by wrapping a piece of insulating tape around it.

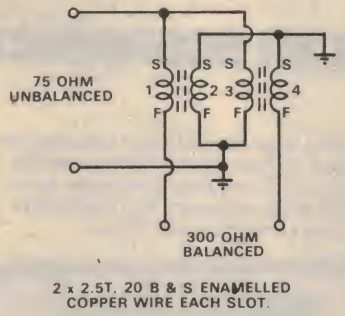
Now check L2 by approaching one end of it with the iron dust slug and if the signal strength meter rises, the coil should be shortened. If the signal strength decreases, the coil should be lengthened. The correct adjustment has been reached when the signal strength falls when either the iron slug or the brass rod are inserted into the coil. The process is repeated for L1. In most cases, it is more likely that you will have to shorten both L1 and L2.

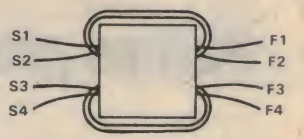
Set the gang to the other end of its travel and then bring it back a couple of degrees or so. With the generator, search for a signal around 108MHz. The trimmer associated with L3 must be adjusted so that 108MHz is tuned at the setting of the gang. Now adjust each of the trimmers associated with L1 and L2 for maximum signal strength reading. It should be noted that during these adjustments, as well as those at the other end of the range, the output of the signal generator should be reduced as adjustment proceeds.

In common with the alignment of all superhet systems, the process at each end of the range must be repeated until alignment is complete.

At right are the winding details for the three airwound coils L1, L2 and L3.







Full details of the balun transformer are shown at left and directly above.

Although the alignment is complete at this stage, we should point out that it may need a touch up when the complete unit is fitted into a cabinet with a calibrated dial scale. Any errors showing up will need to be put right. All that is needed now is a suitable aerial connected to the tuner to receive FM transmissions. In Sydney we have 2MBS at the time of writing and the sound transmission for channels 3, 4 and 5 may also be tuned under favourable conditions. Hopefully, in the very near future, more FM stations will make an appearance in various centres throughout the country.

A simple aerial may be made up with some 300 ohm ribbon. Cut a piece of ribbon 1.34m long. At each end, bare the two leads for about 8mm, tin them and solder them together. At the centre point, cut ONE of the two leads and bare each of the ends for about 8mm. This becomes the feed point for 300 ohm ribbon lead of convenient length from the aerial installation to the receiver. The aerial proper, which is the piece 1.34m long, should be tacked to a piece of batten board to stiffen it. The aerial should then be mounted well in the clear for best results.

At the present time, 2MBS is using a transmitting aerial with vertical polarisation and this means that your aerial must be mounted vertically if it is to be properly effective. It may be worth mentioning at this stage that some electronics suppliers are offering multi-element FM aerials and these would be superior to the one just described, where difficulty may be experienced in getting a good signal. These aerials must also be mounted vertically for 2MBS. It is also worth mentioning that if you wish to receive some of the TV sound signals at present in the FM band, the aerial may have to be mounted horizontally.

At the time of writing, we have completed the development of an AM tuner which we feel is a worthy partner for the FM tuner. We hope to describe the AM tuner and power supply completely mounted in a cabinet with the FM section in an early issue.

LIST OF COMPONENT PARTS

1 Printed circuit board 76.5mm x 58mm(75FE5)
1 AM/FM 3-gang Roblan (7-40pF and 10-240pF)
2 Transistors MFE131, FTO601, BFR84
1 Transistor BF199
1 Diode varicap BB105G
1 Copper laminate board 127mm x 76mm
5 Printed circuit board terminal pins (McMurdo)
1 Balun core Neosid type 1050/1/F14
1 Neosid 7.6mm grade 900 slug with hex bore.

RESISTORS (¼ or ½ watt)
1 22 ohms
1 47 ohms
2 270 ohms
1 330 ohms
1 3.3k
1 12k

CAPACITORS
1 18pF NPO ceramic
3 20pF trimmers, Philips or McMurdo
1 47pF NPO ceramic
3 68pF NPO ceramic
2 330pF 630V polystyrene
1 .001uF polycarbonate
4 .01uF 63V ceramic
2 0.1uF 63V ceramic

Sundries

Screws, nuts, solder lugs, solder, TC wire.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may be generally used, providing they are physically compatible. Components with lower ratings may also be used in some cases if available, providing ratings are not exceeded.

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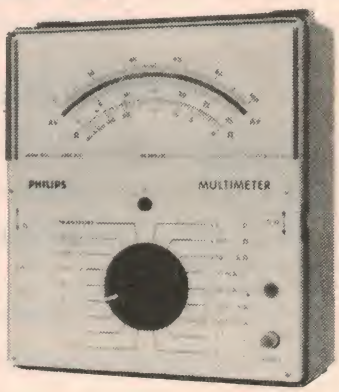

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Transistor-assisted Ignition System

While capacitor discharge ignition systems are a very popular addition to the cars of electronics enthusiasts, many people are still wary of their reliability of operation. For these people, this "transistor-assisted" ignition should be of interest.

by LEO SIMPSON

In presenting the Capacitor Discharge Ignition system in last month's issue we were very conscious that reliability of the circuit is all important and we were at pains to ensure that the reader received this message loud and strong. So much so that some of our readers may swear off CDI for life.

So we were gratified to come upon this alternative circuit which we are reproducing without alteration from the April 1975 issue of "Wireless World". It uses the existing ignition coil in the vehicle and relieves the points of their arduous task—thus allowing the ignition system to operate at peak performance.

Operation of the circuit is as follows:

Transistor Tr1 is a constant current driver stage for Tr2. Diodes D1, D2 and D3 set the base reference voltage for Tr1 so that it maintains a constant voltage across its emitter resistor and thus holds its collector current at a constant value regardless of the collector voltage.

Tr1 is turned on and off by the points in the distributor. When the points are closed, current flows in the 50 ohm/2W resistor and turns Tr1 on.

Virtually all of the collector current of Tr1 (or its emitter current in the positive chassis version) flows into the base of the Tr2. Thus, whenever Tr1 is on, Tr2 is also conducting and vice versa. Tr2 carries the heavy coil current which would otherwise flow in the points.

In order to withstand the high voltages developed in the primary of the ignition coil, Tr2 must have a suitably high voltage rating as well as the ability to switch the four or five amps of coil primary current. We have used the BDY98 which is a 600V transistor intended for use in switching regulators and motor control systems. It has a collector current rating of 10 amps (15 amps peak) and a power rating of 40 watts.

The resistor of 10 ohms between base and emitter of Tr1 is required to "tie" the base solidly to its emitter so that is is able to fully withstand high voltages from collector to emitter. With the base open, the voltage rating of the transistor is reduced to only 250V DC.

So far, readers should see that Tr2 can easily withstand the positive high voltages developed by the coil primary. But it may not be clear how it withstands the negative voltage peaks as the coil primary resonates with capacitor C. In fact, the transistor does not withstand the "backswing"!

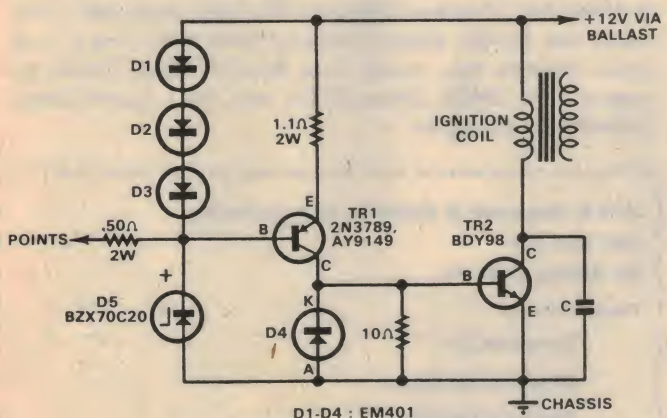
What actually occurs is that the base-collector junction of Tr2 is forward-biased by the backswing of the coil and thus any negative voltages which would otherwise be developed are clipped. This causes no damage to the collector-base junction of the transistor but diode D4 has to be included to protect the base-emitter junction and Tr1.

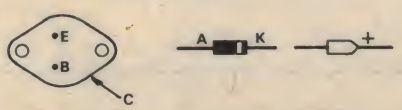
It may be thought that this clipping of the coil backswing would reduce the available spark energy. This is not the case. Careful observation of an ignition system using a wideband oscilloscope shows that while the spark discharge is actually occurring, the coil secondary resonates with its distributed capacitance at about 10 to 15kHz. When the spark is extinguished, the remaining coil energy is dissipated by means of resonance in the primary circuit at a much lower frequency.

This means that clipping of the coil primary backswing voltage does not affect the spark duration or energy at all.

One factor which could well reduce the available spark energy is the saturation voltage of Tr2. With typical devices this will normally be of the order of less than one volt. This means, in effect, that the battery voltage applied to the ballast/coil combination is reduced slightly and thus the primary current will be slightly less than usual. Whether this loss is appreciably more than would be due to contact resistance losses in a normal set of distributor contacts is problematical. It makes little difference to cars driven at normal speeds.

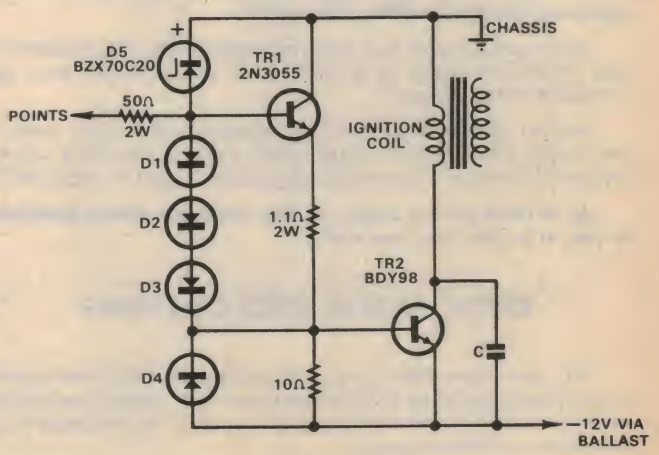
Zener diode D5 is the only remaining component in the circuit which needs to be discussed. D5 protects Tr1 from excessive voltages which could break





TRANSISTOR ASSISTED IGNITION
(NEGATIVE CHASSIS)

(3/TI/13)



TRANSISTOR ASSISTED IGNITION
(POSITIVE CHASSIS)

Negative and positive versions of the circuit are shown on the left and right respectively.

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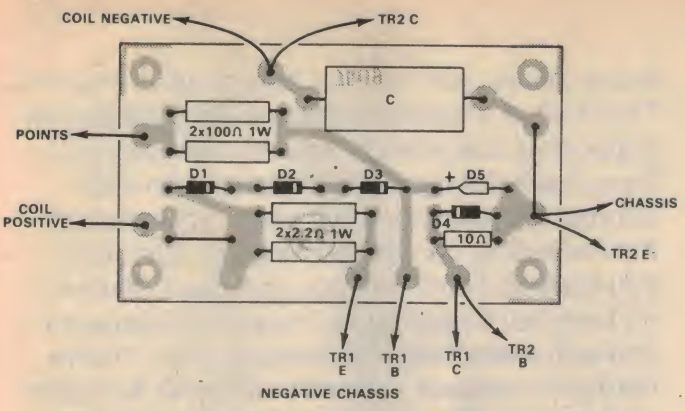
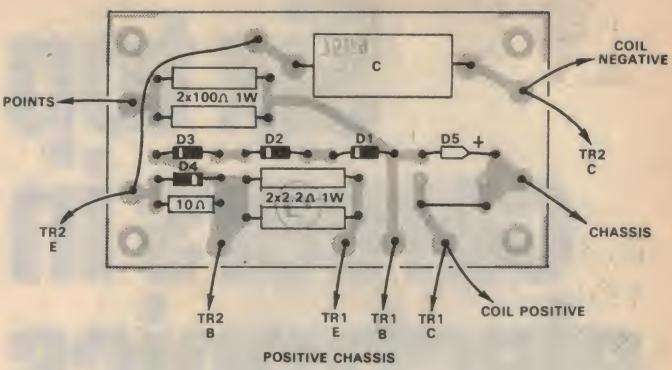
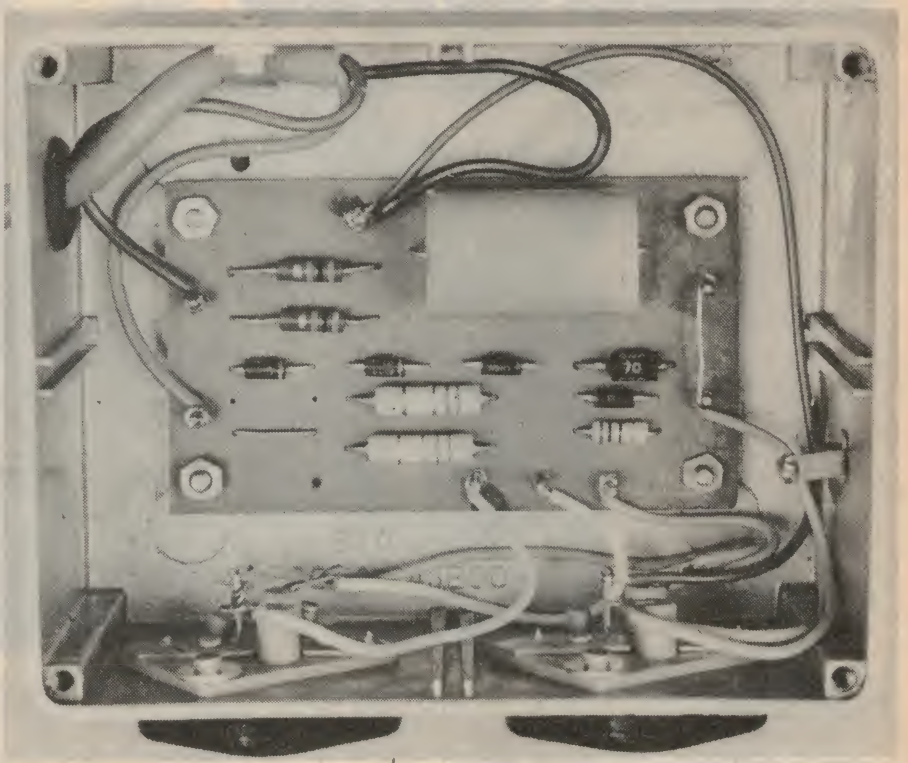




PARTS LIST

1 diecast case. 120 x 95 x 55 mm
1 BDY98 silicon NPN high voltage transistor
1 2N3789, AY9149 PNP power transistor (for negative chassis operation) or
1 2N3055 silicon NPN power transistor
1 BZX70/C20 2.5W zener diode
4 EM401 silicon diodes
1 630VW polyester or metallised polycarbonate capacitor with same value as points capacitor
2 100 ohm/1W resistors
1 10 ohm/½W resistor
2 2.2 ohm/1W resistors
1 PC board, 75ti9, 90 x 50 mm
2 McMurdo TO-3 sockets, part number 2826-01-01
2 McMurdo TO-3 covers, part number 9151-09-01
2 TO-3 mica washers
8 PC stakes
MISCELLANEOUS
Epoxy adhesive, grommet, solder lug, cord clamp, length of three-core mains flex, pop rivets, screws, nuts, lockwashers, 4 x ⅜in x No. 6 self-tapping screws for TO-3 sockets, ½in x No. 10 self-tapping screws for unit mounting, silicone grease or heatsink compound, hook-up wire, solder.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with high ratings may generally be used provided they are physically compatible.



Interior view of the transistor-assisted ignition system housed in a diecast case.

down its base-collector junction. These high voltages are superimposed on the supply line from the ballast resistor when the coil primary winding resonates, as described above.

To make construction easy, we have prepared a PC board which is easily accommodated in a diecast case measuring 120 x 95 x 55mm, as made by STC or Eddystone. The two power transistors are mounted on the side of the case using McMurdo TO-3 sockets and mica washers.

Assembly of the PC board is straight forward. Just follow the appropriate layout diagram for your car. Most cars these days have negative chassis electrical systems, but there are still quite a few cars of British and Japanese origin which have positive chassis systems.

Diodes D1 to D4 are common garden-variety silicon power diodes with a rating of 1 amp. (Actually, if you do find any diodes in your garden, you should regard them with a seedy eye).

Zener diode D5 is a 2.5W type (BZX70) with a 20V rating. If you cannot obtain a 20V unit, an 18 or 22V unit will do just as well.

Parts suppliers will be able to order the BDY98 from Elcoma components division of Philips Industries Ltd.

In the negative chassis version, Tr1 may be any silicon PNP power transistor with a voltage rating of more than 30V and a collector current rating of several amps.

The 50 ohm and 1.1 ohm resistors on the circuit are actually parallel combinations of 100 ohms/1W and 2.2 ohms/1W resistors respectively. These are less cumbersome, cheaper and more freely available than 2W resistors.

Capacitor C should have the same capacitance as the points capacitor in the distributor. You may in fact use a points capacitor, although these tend to be expensive and cumbersome to mount. An economical substitute is to use a polyester or metallised polycarbonate capacitor with a rating of 630VW.

Ideally, capacitor C should be secured to the PC board using epoxy adhesive so that its leads are not prone to breakage due to the severe vibration it will be subjected to.

PC stakes are used for external connections to the PC board. Any type may be used, provided they are a tight fit in the PC board holes before soldering. When terminating wires to the stakes, wrap the stake securely with the wire and then solder.

Use pop-rivets and washers or screws,

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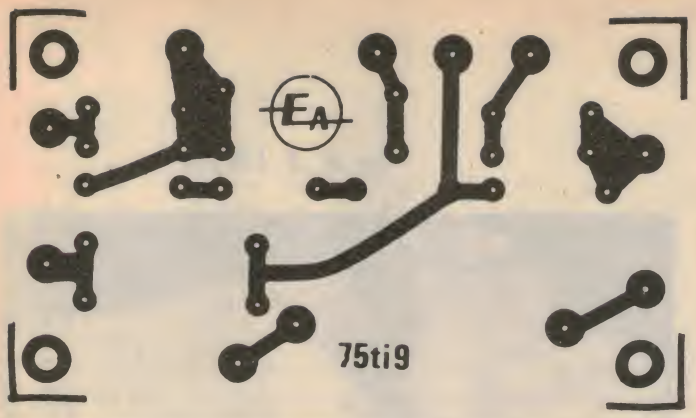
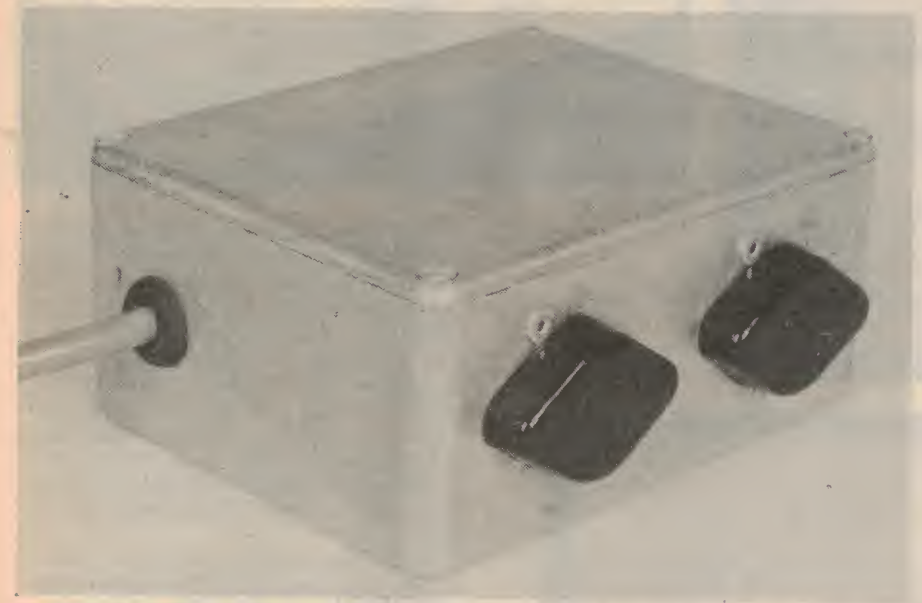


At left is the full size pattern of the PC board.



Use transistor covers to prevent the possibility of accidental short circuits.

nuts and lockwashers to secure the McMurdo TO-3 sockets. Before mounting the transistors, ensure that the contact area is completely smooth and free of burrs and swarf. Smear the contact surface and the underside of the transistors with silicone grease or heatsink compound. You will need to use a mica washer for each transistor to isolate it from the case.

We used TO-3 transistor covers from McMurdo (part number 9151-09-01) to eliminate the possibility of short circuits where tools are inadvertently dropped onto the transistor cases.

For the negative chassis version which most constructors are likely to build, only three wires are needed to make connections from the transistor unit to the coil. These can most conveniently be provided by a length of three-core mains flex. For the positive chassis version, four wires will be needed, and these could be provided by two lengths of figure-8 23/.0076 lighting flex.

Operation of the completed unit can be checked by a temporary connection to the car's ignition system. The points capacitor in the distributor should be left in place.

There is no need to alter the wiring of the vehicle. Install the case by use of a suitable bracket or drill several holes in the bottom of the case and secure it to the vehicle body by means of ½ in x No. 10 self-tapping screws. Make sure that the case is solidly connected to the chassis, as it forms the electrical return path for part of the circuit.

We advocate that connections from the circuit to the coil and vehicle electrical system should be made with the aid of the eyelet/solder lug assembly mentioned in last month's article on capacitor discharge ignition. These form our trigger terminals on the coil and allow circuit connections to be easily made. They also allow easy reversion to the conventional system in the case of a breakdown.

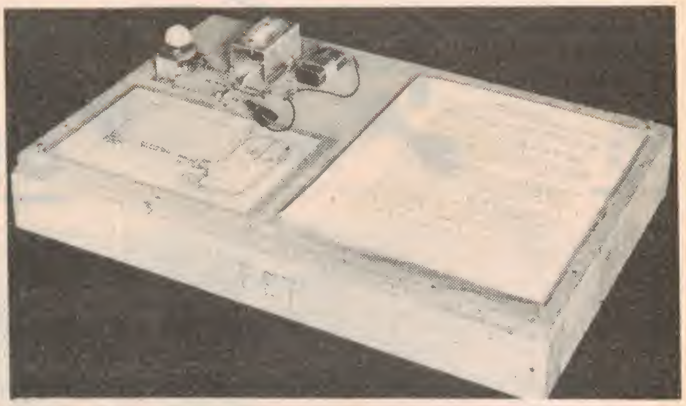
We understand that Watkin Wynne Pty. Ltd. will be able to make these eyelet assemblies available to parts suppliers.

For those who wish to make their own eyelet/assemblies we have included a diagram showing the major dimensions. The material we recommend for this purpose is canvas reinforced bakelite, woven fibreglass board (similar to that used in PC boards) or red vulcanised fibre (as used for making washers). Minimum thickness is $^{1}/_{16}$ in. The eyelets and solder lugs should have an internal diameter of $^{3}/_{16}$ in. to suit the terminal posts of the coil in the vehicle.

Practical electronics demonstration:

DIODES

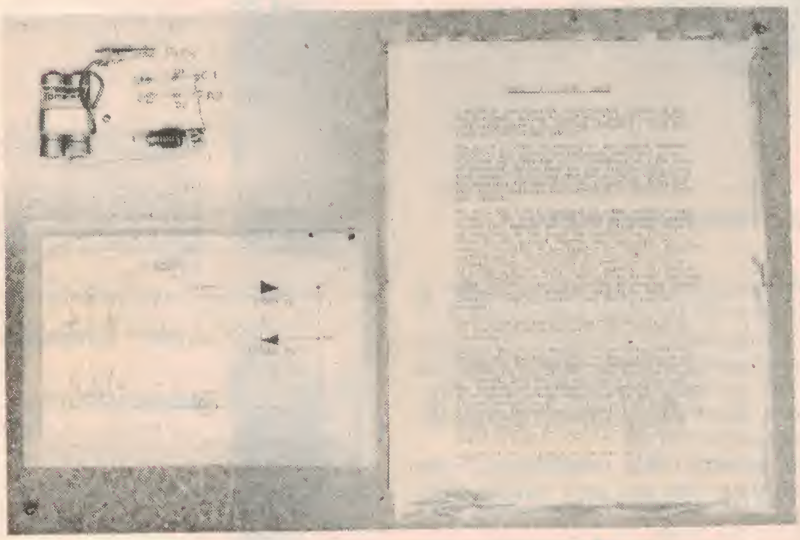
by A. J. LOWE

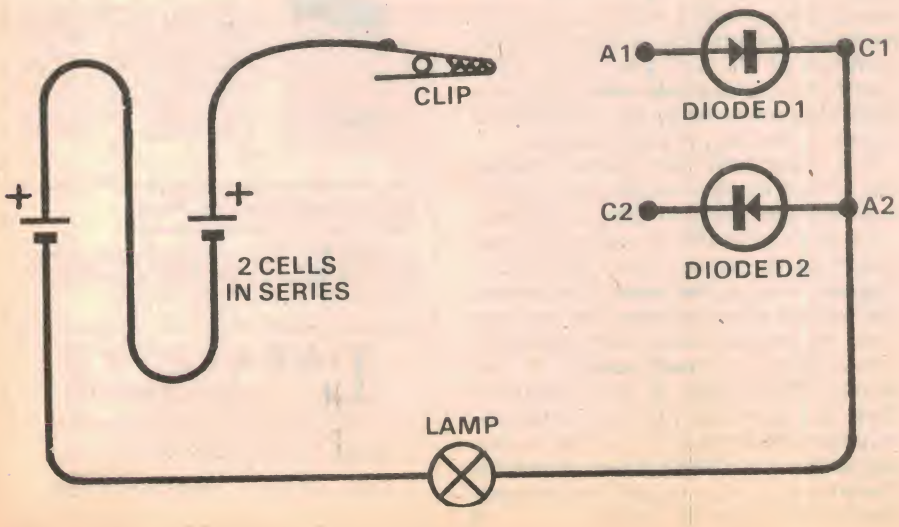


Above: Fig. 1.

Left: Fig. 2.

Below: Fig. 3.





This is the first in a series of articles which will describe a number of "Teach Yourself Boards" made, and found useful, for helping young enthusiasts to understand what the basic semiconductors and some electronic circuits do. It is thought that the ideas contained may inspire people in charge of radio and electronics clubs to produce something similar. On the other hand, there is no reason why beginners should not make them for their own interest, and learn as they do so.

Note carefully that the aim of these boards is to show basically what devices do—not how they do it. There is no mention in the script, which is on each board, of such concepts as holes, doping, or the other "inner secrets" of electronics. They are meant to be practically demonstrative rather than theoretically explanatory.

There is not even a mention of the distinction between npn and pnp transistors. Some may sneer at this but it is believed that the recruits to our hobby would prefer to know—initially at least—the answer to the question "What does a transistor do?" rather than to the question "How many types of bipolar transistors are there?" and so on.

On that basis these boards are offered as ideas for those who want to help the young, and as ideas for those young who would like to help themselves.

Fig. 1 shows a typical board made of 13mm chipboard. The size is 450mm x 300mm x 65mm high. Boards stack together as shown in Fig. 2. One woodscrew sticking out from the working surface near the top right hand corner, and one near the bottom left hand corner on each board act as locating pins so that when the boards are stacked they remain in line. The screws fit neatly inside the corners of the board next above.

On each board is a wired electronic circuit in the top left hand "quarter". Some boards have batteries included and some need an external battery or power

WHAT A DIODE DOES

A diode is the simplest semiconductor device. It has two terminals called "anode" and "cathode". A diode will pass current in ONLY ONE direction—in at the anode and out at the cathode.

The model is wired up exactly as the circuit diagram below it. Two diodes are included, but wired up in opposite ways. Put the clip on terminal A1—the anode of D1. Notice that the lamp lights. This shows that current IS flowing from the positive terminal of the battery, through diode D1, through the lamp, and back to the battery. The current flows clockwise round the circuit.

Now move the clip to the terminal C2—the cathode of the diode D2. The lamp does NOT light, because current flow cannot flow through the diode D2. Notice that the diode D2 is connected in the model the opposite way round to diode D1. The circuit diagram shows the arrow head in diode D1 pointing to the right—the direction in which current has to flow to light the lamp.

The circuit diagram shows that the arrow head in diode D2 is pointing to the left, so that current would have to flow anticlockwise around the circuit to make the lamp light. But the battery is connected to make the current flow only clockwise round the circuit, so diode D2 prevents any current from flowing from the battery.

The line painted round a diode, near one end, shows the end out of which current can flow. Check this on the model.

Now move the clip to terminal C1 and notice that the lamp is brighter than it was when the clip was on terminal A1. This shows that more current is flowing when the clip is on C1; that is, when the diode is not in circuit. From this you may rightly conclude that the diode causes some loss in the circuit.

If you care to measure the voltage across diode D1 when current is flowing through it, you will find that the voltage is 0.65 volts. This is typical of the voltage drop across a silicon diode (which these diodes are). The voltage drop across a diode stays steady even if the current is varied. The diodes do not follow Ohm's law—they do not behave like a resistor.

Please put the clip back on the "PARK" pin.

(Note: All references to the direction of current flow in this and subsequent lessons are based on what is termed "conventional current flow". Later, you may encounter a different definition based on "electron flow" but there is no need to worry about this at the moment. The difference in concept does not affect the validity of these demonstrations in any degree.)

supply. The wiring is made open and clean—using bare wire soldered round copper-plated nails known as "fixing pins" in the electrical trade. Components used were mostly in the recovered, repaired, or junk box category, in order to keep costs down.

Below each wired circuit is a circuit diagram drawn in the same way as the wired circuit, with components in the same relative positions, so that the various bits and pieces can be readily identified. The circuit diagrams are protected with a covering of clear adhesive backed sheeting. ("Contact".)

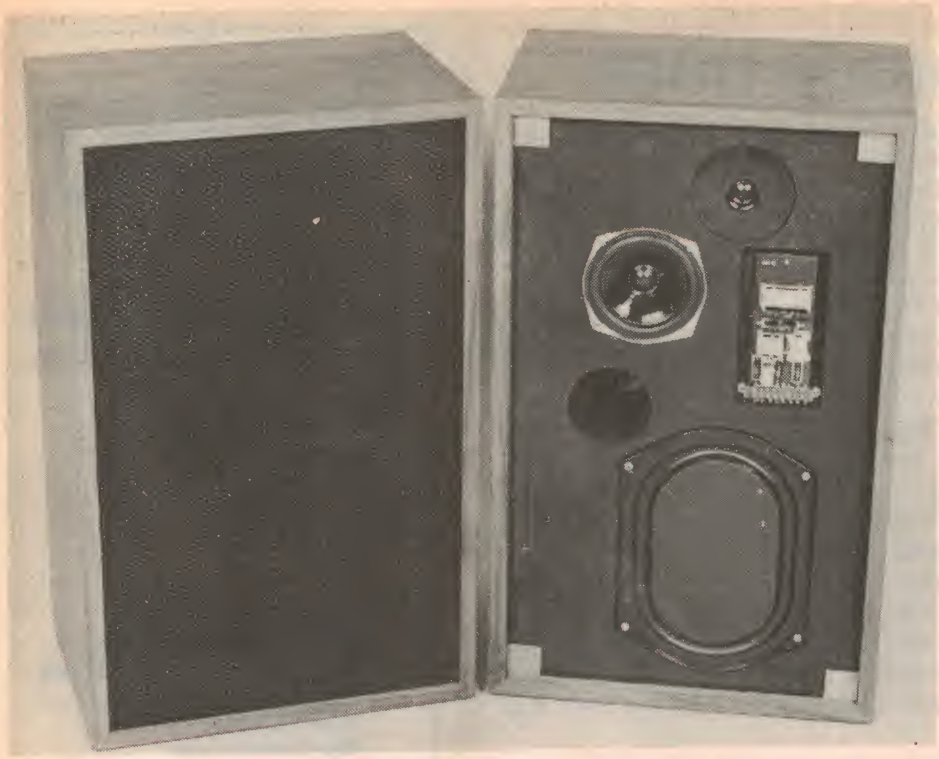
On the right hand half of each board is a sheet of instructions in a clear plastic envelope stapled to the board.

This general introduction applies to all the boards. Let us look now at the board showing the simplest semiconductor. It is called, "What a diode does". Fig. 3 shows the layout of this board, and the circuit is as shown in Fig. 4. Any 1 amp diodes could be used—such as 1N4004.

The battery clip is made from a small strip of aluminium. The lamp holder was rescued from an old radio, but suitable holders are readily available.

PARTS LIST

2 diodes 1N4004 or similar 1 amp silicon diodes
1 lamp holder
1 lamp suitable for 2 cell torch
2 AA cells
Clip, wire, nails, aluminium



A stereo pair of high quality loudspeaker systems made up in our laboratory from KEF/Interson CK3/CS3 kits. Note the crossover network mounted in a well in the baffle. We used a black fret cloth which has been rendered more transparent than it really is by the studio lights. Normal price for an equivalent pair of KEF "Concerto" systems would be $510.00.

High quality system uses KEF drivers

Here's a build-it-yourself loudspeaker system intended for those who want something more ambitious again than the Playmaster 3-45L described in the April issue. From the information in this article, you can put together a system which is equivalent to the very well known KEF "Concerto", sold by hifi dealers throughout Australia.

by DAVID EDWARDS & NEVILLE WILLIAMS

As you might remember, the 3-45L was a 3-speaker system using a 45-litre ported enclosure, with a nominal power rating of 30 watts. The basic aim of the design was to achieve high quality sound for the lowest possible outlay and this design objective was certainly met. The sound is very good and the price is, indeed, attractive. For example, Messrs. 451 Sound Centre, mentioned in the original article are currently offering a kit for the complete system at about $59.50 in whitewood form, $65.50 semifinished, and $75.50 finished and ready to go. It was—and still is—a very attractive proposition.

But what of the enthusiast who has more money to spend on a more ambitious system? While it may have been possible to scale up the 3-45L approach in some way, we were not convinced that the result would have all that much more to offer in a domestic situation. Instead, we decided to look for something distinctly more ambitious in terms of concept, specifications and—inevitably—cost!

With this in mind, we took up the matter with Interson Pty. Ltd., of 64 Winbourne Rd., Brookvale, N.S.W. The company distributes the full range of English-made KEF loudspeakers, crossover networks, baffle and cabinet kits, as well as fully built-up KEF systems. After due discussion, we decided that something like the 3-speaker KEF "Concerto" would be the thing to go for, having in mind that would-be constructors could buy the basic components separately, according to their needs, or a complete system kit.

The "Concerto" is a 60-litre system using three matched drivers: a B-139 bass driver with flat plastic cone and rated for 50W in a reflex enclosure; a B110 midrange driver, also 50W and a T27 dome tweeter. The speakers can be bought separately, but Interson package them as a kit (KEF SK3) complete with cross-over network, connectors and wires and cardboard loading tubes for $144.00 (current price). Constructors able to fabricate their own cabinets could simply buy this kit and do the rest themselves.

For those who lack the necessary facilities or skill, Interson can supply factory pre-cut, surfaced panels which need only to be glued together to form a complete enclosure. The CK3 cabinet kit, which sells for $45.00, contains the acoustic wadding and the fret framework but not the actual fret cloth.

Allowing a few dollars for oddments and finishing materials, a KEF SK3/CK3 (Concerto) system constructed in the home from a factory kit is likely to cost just under $200 for a single unit, or about $400 for a stereo pair. This is certainly not pin money but the fact is that a pair of fully finished Concertos lists at $510.00—a saving of more than $100. A professional or neo-professional cabinet maker might save more again—provided he had ready access to materials and facilities.

How you approach construction of the system is, of course, a matter for individual decision but a few cautionary remarks may be in order, to anticipate some of the situations which inevitably arise from a project of this nature.

Firstly the system was designed around the three nominated KEF drivers by engineers at the British factory, working under the guidance of Raymond Cooke (see our August 1974 issue). The substitution of other loudspeakers, irrespective of individual merit, would invalidate the original design effort. If you decide to follow such a course, you would necessarily be "on your own".

On the other hand, the crossover network could be made up from basic materials by those with the available resources. Provided it conforms to the nominated circuit and values, it should do the same job. However, we have not attempted to provide constructional details. Apart from anything else, air-cored inductors for such a low crossover frequency are likely to be unduly bulky and costly in present circumstances.

As far as the enclosure is concerned, it could be fabricated from basic materials to the appropriate dimensions and, if well built, should work out just as well as the factory pre-fabricated article. If not well built, or constructed to other dimensions, the result could be

anybody's guess.

During discussion, Interson stressed to us that KEF "Concerto" is the name of a commercial product and may only be used for that product. Its equivalent, assembled completely from KEF/Interson factory supplied components, is most appropriately identified as KEF SK3/CK3, as on our Fig. 2.

If you decide, alternatively, to put together a system using KEF drivers and circuitry, but your own electricals and/or joinery, we suggest your refer to it by our own project title "Playmaster 3–60L" (Fig. 1) Discussion of names may seem rather pedantic to the end user, particularly as the quality of reproduction should be identical. However, a little care may avoid arguments in the tender area of trade names and advertising.

Fig. 1, designated as "Playmaster 3–60L" is for the guidance of constructors who may want to build their own enclosures from basic materials. The diagram gives essential internal dimensions but largely leaves to the constructor the precise method of assembly, depending on the skills and facilities available. The external finish would also be a matter for individual choice but it would be a pity to compromise a system as ambitious as this with a finish either improvised or inappropriate.

KEF recommend high density veneered chipboard as the preferred material for such a cabinet. Low density chipboard is unsuitable, as it is lighter and less rigid and its tendency to flake makes for poor joints. Plywood or solid core is also suitable, but only the best quality should be used.

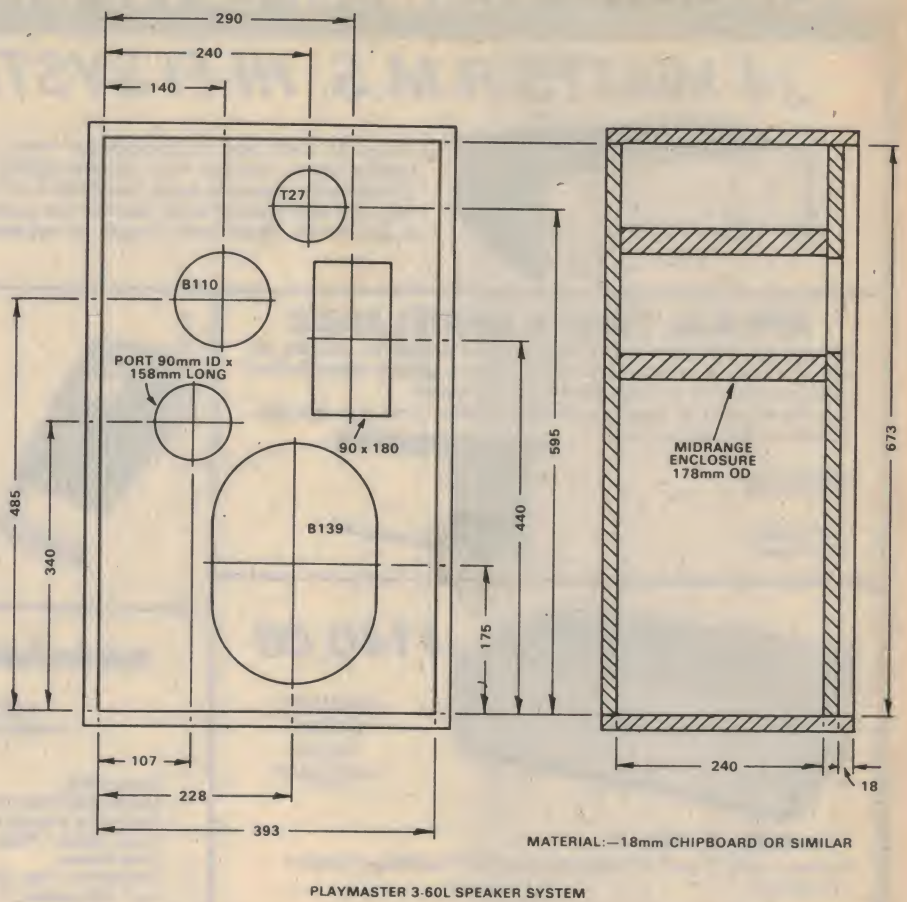
Solid timber is dense and therefore excellent from the acoustic stand point, but it must be well seasoned to minimise the risk of splitting and warping. The minimum recommended material thickness is three-quarters of an inch. Thicker materials will give improved acoustical results, but will increase the size and weight of the cabinets.

The methods used in the construction of loudspeaker cabinets are not critical, provided that all joints are mechanically sound and rendered airtight by glue or caulking compound. The use of PVA adhesive is recommended. Solvent based adhesives may be used but KEF suggest that they be allowed to dry thoroughly to prevent damage to the speaker units caused by vapours.

The liberal use of glue blocks or corner fillets is recommended. Self adhesive foam plastic strip (draught excluder) is useful in making airtight joints around any panels that are made removable. Back panels are particulary prone to vibration because of the large area; if not glued in, they should be well secured by screws every few inches.

Before deciding on your own constructional methods, it would be wise to study the way the KEF factory kit goes together (Figs. 2, 3 & 4). It is glued together permanently and access to the

FOR READERS WITH JOINERY FACILITIES:



PLAYMASTER 3-60L SPEAKER SYSTEM

Fig. 1: Given the necessary joinery skills and facilities, some enthusiasts may be able to make up their own enclosures from basic materials, at a considerable saving. The above diagram shows the important internal dimensions. The position of the loudspeakers and cutouts can be judged well enough from the diagram and photos, but accurate templates for the drivers are obtainable from the distributors. The precise method of construction and the surface finish can be a matter for individual choice. For the sake of identification, a system using the KEF drivers and circuitry with fully home-built enclosure should be referred to as the "Playmaster 3-60L".

enclosure can be gained through the loudspeaker cut outs.

In the CK3 enclosure kit, the tube enclosing the midrange loudspeaker is intended to be glued between the baffle and the rear panel, thereby helping to make both very rigid. The rear face of the baffle and the inner face of the back panel are both rebated by about 4 mm to provide a well for the glue, rather than a simple butt joint.

The face of the baffle is also rebated to accept the loudspeaker frames, the tweeter face being marginally behind the baffle surface, the other two protruding only a small amount. Another cutout, backed by a glued panel, provides a space for front mounting the pre-assembled cross-over network.

If you do not have access to rebating facilities, an equivalent result could be obtained cutting out and glueing together suitable thinner panels. While KEF flush mount the speakers, at least the woofer could be surface mounted, provided sufficient clearance is available between it and the fret cloth. The divider network could as easily be mounted on the floor of the enclosure, with access through the woofer cutout.

In choosing a grille cloth, remember that it must be acoustically transparent, particularly to the higher frequencies. Woven materials should have an open weave, free from fuzzy threads. Proprietary makes, available from most electronic parts suppliers, are recommended. Grille materials may be kept taut by an underlayer of plastic foam. Alternatively, a fret frame similar to that supplied as part of the CK3 cabinet can be made, and used as recommended.

Inside the cabinet, a certain amount of absorbent material is necessary to inhibit the formation of standing waves. Various materials can be used but the most convenient is probably bonded acetate fiber wadding used as in the CK3 kit. This does not shed loose particles, nor does it irritate the skin. Resin bonded fibreglass is acoustically equivalent, but may cause skin irritation.

Alternatives include rockwool,

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POWER OUTPUT:
25 watts per channel R.M.S. Total output 50 watts R.M.S. 8 Ohms
FREQUENCY RESPONSE:
20 cycles to 40,000 1dB
HUM & NOISE:
Aux. 70dB. Mag. 60dB.
INPUT SENSITIVITY:
Mag. 2mv Aux. 250mv.
EQUALISED:
Mag. RIAA.
TONE CONTROLS:
Bass 50 cs 13dB. Treble 10kc s 15dB.
HARMONIC DISTORTION:
Less than .05 per cent.
LOUDNESS CONTROL:
50 c s 10dB.
SCRATCH FILTER:
(high filter) at 10kc s 5dB.
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Record or playback with din plug connector.
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Two sets of speakers can be connected and selected by switch on front panel; they can also be driven together.
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DIMENSIONS:
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Deluxe version of the 143 amp. with high & low filters as used in the 140 playmaster plus loudness control **$7.80 extra.**

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For 27240 or 27880 Khz operation (state which required) with switch position for additional two-channels tone call signal, noise squelch control, circuit contains 13 transistors, diode and thermistor. Transmitter stability crystal controlled .005 Ceramic filter. Aerial 9 section telescopic powered by 8 1.5v UM3 batteries. Range up to 10 miles depending on conditions. Battery check meter. Attractive and durable die cast case with provision for external speaker, aerial and power supply. $49.50.

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At last a breakthrough in the cost for high quality portable radio transceivers of the walkie-talkie hand-held type. We are introducing and offering for sale a fully PMG approved transceiver.

cellulose wadding, felt and wool waste. Denser grades of expanded polyurethane are also suitable, but egg trays and acoustic ceiling tiles are not recommended by KEF for this particular purpose.

So much for those who may want to do their own joinery—an area where many readers could doubtless marshall far more skills and facilities than we can. As far as we were concerned, we took the less demanding approach and obtained two complete CK3 and SK3 kits from Interson, putting them together as per the instructions that came with them. We had to supplement the instructions here and there but, in the end, finished up with a pair of loudspeaker systems which are eminently satisfactory in terms both of performance and appearance.

THE KIT APPROACH

The first step in constructing the system from the KEF/Interson kit is to undo both the CK3 cabinet kit, and the SK3 speaker kit, and familiarise yourself with the various parts, and the way in which they are assembled.

As well as the parts supplied in the kit, you will need the following extra materials and tools: PVA adhesive, 1¼ inch panel pins, blackboard paint (flat black), sandpaper, grille cloth, finishing materials for the cabinet, a hammer, a screwdriver, a stapler—and a large clear working area!

Lay the baffle (C) face down (the speaker cutouts are rebated on the face) on a flat surface, and place the four T-nuts into the holes around the bass speaker cutout. Gently tap them down with a hammer.

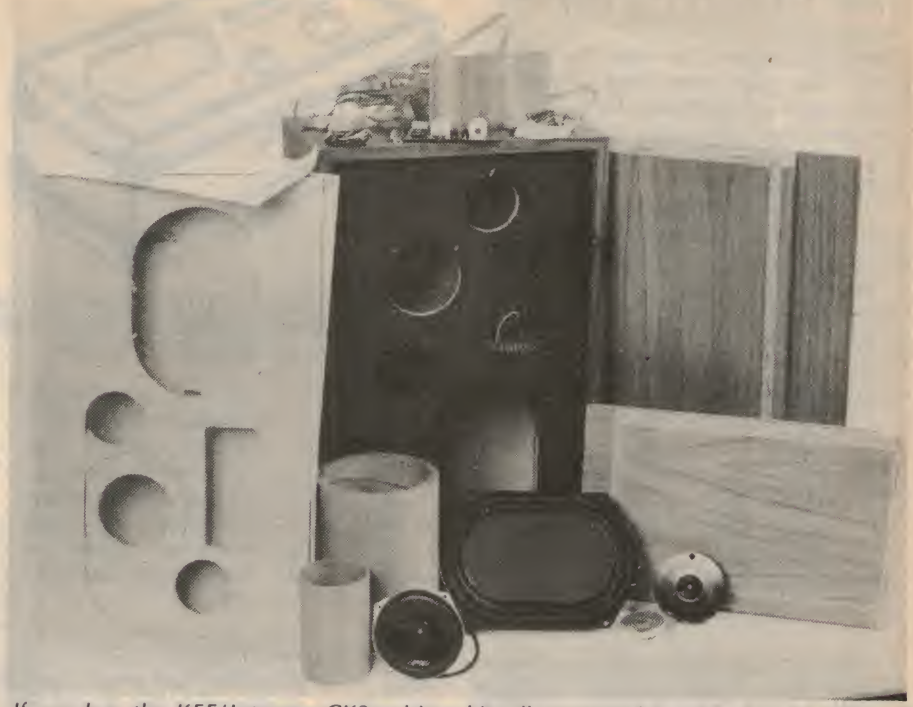
If you have been supplied with extra T-nuts, as we were, these may be fitted into ¼ inch holes drilled around the midrange speaker cutout. Take care that the rebate for the midrange loading tube is not fouled during this operation. Use the midrange speaker itself as the template to determine the position of the holes.

Glue and nail the cross-over block (D) in position over the cross-out cutout. Again, make sure that it does not foul the midrange loading tube, and that sufficient glue is applied to ensure that the joint is airtight.

At some stage prior to final assembly, it is necessary to paint the front of the baffle, the front of the fret, and the inside of the port flat black. When painting the baffle, make sure that all the rebates for the speakers, and the rebate for the cross-over, are painted. The idea is to paint any surfaces which may be seen when the fret is removed.

Also before the final assembly, it is a good idea to fit the speakers and the cross-over network temporarily to the baffle, to check that all is correct. The cross-over is fitted in the PC board edge connector, which is then screwed to the panel backing the cutout. Place a felt washer under each screw. The third and largest screw is used with the two

BUILDING THE SYSTEM FROM A FACTORY KIT:



If you buy the KEF/Interson CK3 cabinet kit, all you need is a few hand tools and oddments, and space to work. When this picture was taken, we had completed the assembly of one enclosure to the point where it was ready for the drivers to be installed. The other enclosure was a conglomeration of panels and tubes. Measuring about 710mm (28in) high, the systems are obviously meant to be free-standing, without being large and bulky. They could take pride of place, however, in any domestic hifi installation.

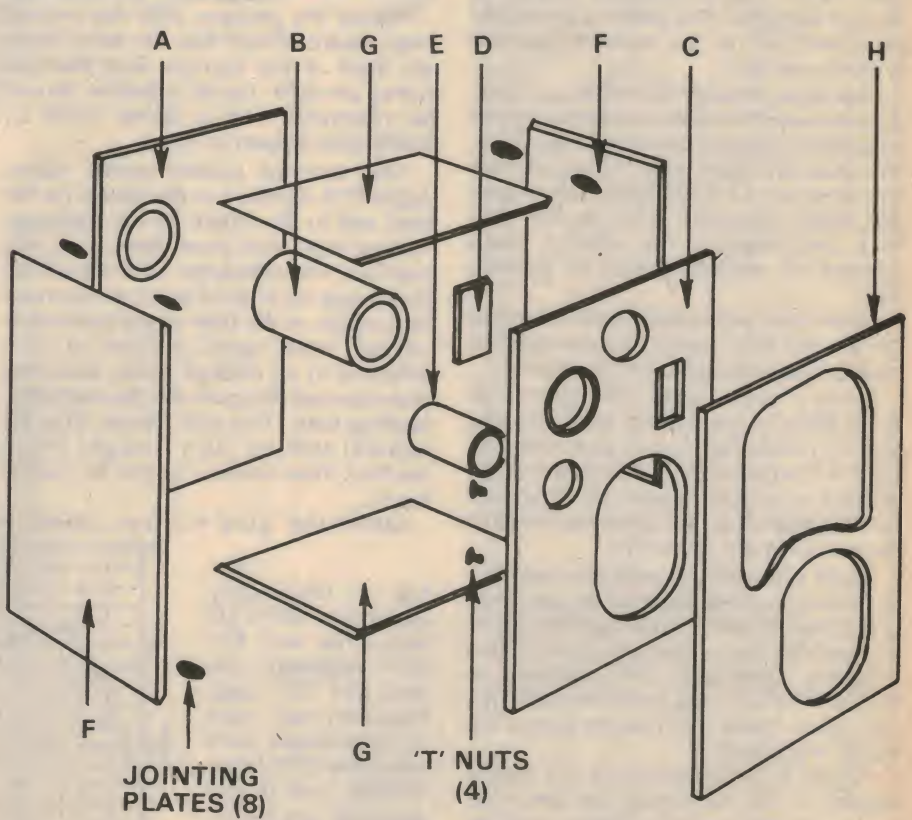


Fig. 2: Re-drawn from the literature which comes with the CK3 cabinet kit, this diagram shows how the enclosure goes together. The diagram should also be studied, in conjunction with the text, by those who may prefer to fabricate their own from basic materials. Note that the tube enclosing the mid-range driver provides a rigid brace between the front baffle and the rear panel.

remaining washers to hold the PCB in place. The edge connector should be positioned so that the PCB can be removed when the single screw holding it is removed, without unscrewing the edge connector.

A ¼-inch hole should be drilled in the back of the cross-over cutout, for the wires to the speakers. These are supplied in the correct lengths, and are colour coded. Also, drill two small holes in the midrange loading tube, close to one end.

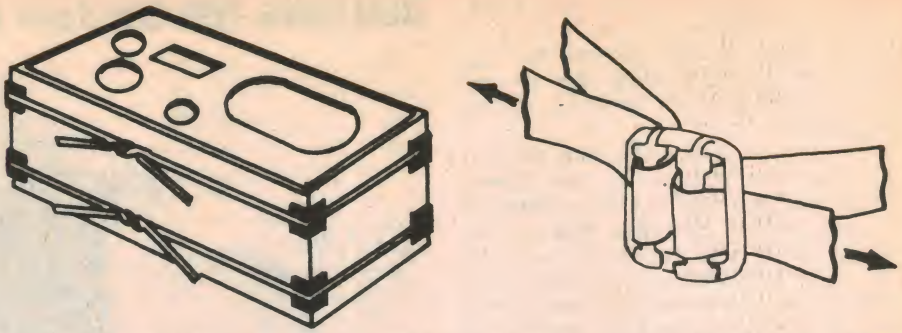


Fig. 3 (left) shows how the straps and edge blocks supplied with the CK3 cabinet kit are used to hold it firmly while the glue sets. Fig. 4 (right) is a detail of way the strap is threaded through the buckle.

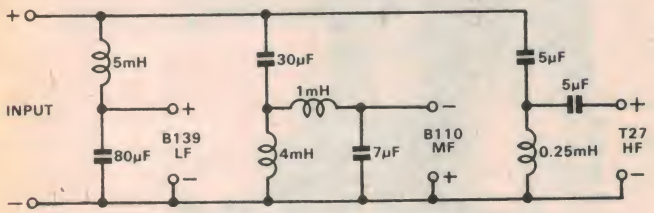


Fig. 5: Circuit details of the crossover network, which is sold as a unit by Interson. It uses ferrite cored inductors. Air-cored inductors would be very large, and costly.

Pass the 15-inch black and green wires through these holes, and knot them on either side. The wires should extend into the tube so that they just reach the other side.

Now solder the 33-inch white and black wires to the screw connector supplied with the SK3 loudspeaker kit, and screw it into position using the screws supplied. The white wire should be connected to the terminal marked with the red dot.

The wires through the midrange loading tube, and the screw connector on the rear panel can now be sealed into place. We used an epoxy glue, to ensure that the joints were fully airtight. Do not glue the screw connector itself, as this may lock the threads. We used a small amount of modelling clay to prevent this.

With these preliminary tasks attended to, we are now ready to assemble the panels into a recognisable enclosure.

Using a brush, apply PVA glue to all mitre faces of the cabinet ends (G) and sides (F). Take care not to allow the glue onto the veneered surfaces, as it may be difficult to remove. Insert the eight oval jointing plates into the slots machined in the mitres of the sides (F).

Stand one side (F) and one end (G) with the veneered edges facing upwards, and press the mitre firmly together, making sure that the jointing plates are seated properly. Then apply PVA adhesive to the baffle rebate, and insert the baffle (C) into place. Make sure that the face of the baffle is upwards.

Apply PVA adhesive to the baffle rebates of the remaining end and side, and press these into position, making sure that the jointing plates are seated correctly, and that the mitres are pressed tight.

Take one pressing strap, and thread both ends through the buckle as shown in Fig. 4. Repeat with the second pressing strap. Then place the first strap around the cabinet as shown in Fig. 3 with the four plastic mitre protectors in position, and draw the strap tight. If necessary, grip the ends of the straps with pliers. We found that this job was much easier if two people co-operated, with one pulling on each end of the strap.

Repeat the process with the second strap. Make certain that the mitre faces are level at the corners, and that the mitres are tight. Excess adhesive should be removed with a damp cloth or toothbrush dipped in water.

Now turn the cabinet upside down. Apply PVA adhesive to the rebate for the port, and to the rebate for the midrange loading tube, and press them both into position. The midrange tube should be positioned so that the wires are as close as possible to the hole in the cross-over cutout. Now apply a fillet of PVA adhesive to all internal joints, including those around the port and the midrange loading tube. This will ensure that the cabinet will be fully airtight when finished. Then leave it to dry for twelve hours.

Once the glue has set, apply a generous amount of PVA adhesive to the midrange loading tube rebate in the back of the cabinet and to the rebate around the cabinet back, and then carefully fit the back into position. Make sure that the midrange loading tube is seated correctly, and that the joint is airtight.

Using 1½-inch panel pins, secure the back into position. Be very careful how you drive them in as they may deflect and come out through the side veneer. Later PVA adhesive can be run around the outside of the join to seal any possible leak.

In the meantime, turn the cabinet over on its back and, working through the midrange cutout, run a fillet of adhesive between the inner surface of the midrange tube and the back panel. Leave to set.

With this work finished and the adhesive well and truly set, the pressing straps can be removed. The next step is to complete the internal wiring of the cabinet.

Feed the wires from the midrange loading tube, and those from the rear connector, through the hole in the rear of the crossover cutout. Using the table provided as a guide, solder them to the edge connector.

The 24-inch wires to the bass driver and to the tweeter unit can also be connected to the edge connector, and then pushed through the hole in the crossover cutout. The edge connector should then be screwed into place, and the hole in the cross-over cutout sealed with an epoxy glue.

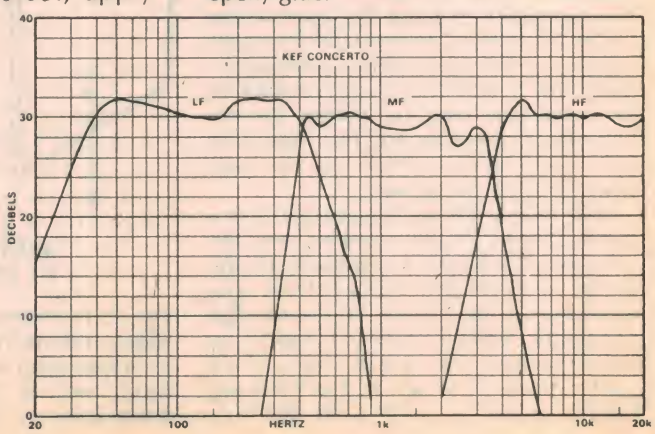


Fig. 6: Frequency response of KEF B139 bass driver unit, KEF B110 midrange unit and KEF T27 high frequency unit, used in conjunction with crossover DN12 type SP1004, and in the specified enclosure. Measured at 1 meter on axis in anechoic conditions.

The next step is to complete the external finish of the cabinet. Sand all surfaces smooth along the grain with No. "0" sandpaper. Remove all dust with a rag slightly dampened with mineral turps.

The cabinet can now be clear finished, using either a gloss or a matt finish clear enamel, such as "Estapol". If desired, the cabinet can be coloured beforehand. We used a matt finish on our cabinets, in conjunction with a scandinavian teak oil. This gave a natural teak oil look, whilst retaining the tough qualities of an "Estapol" finish. The directions for obtaining this finish can be found on the label of the "Estapol" instant matt enamel tin.

The final stage of construction is to make the grill frets. Approximately two-thirds of a yard of grill cloth is required for two enclosures, assuming a width of approximately five feet. We used a black cloth, as this went quite well with the dark brown cabinets. Cut the cloth into two sections, each slightly larger than the fret to be covered.

Stretch the cloth out on a flat surface, so that any pattern in the cloth is not distorted. If the pattern has horizontal and vertical stripes, ensure that these are everywhere at right angles. Some form of tension must be applied to the cloth. We did this by stapling the edges to a sheet of particle board.

When you are satisfied that all is correct, coat the front of the fret (previously painted flat black), with PVA adhesive, using a paint brush. Do not spread the glue very thickly, as it may show through the cloth. Then carefully lay the fret onto the cloth, so that the edges of the fret line up with the pattern, if any and allow to dry. It may be necessary to add some weight.

EDGE CONNECTOR WIRING

Edge connector	Wire	Termination
i/p +	white 33"	input terminal red
i/p —	black 33"	input terminal
hf —	black 24"	treble negative
hf +	blue 24"	treble positive
mf +	green 15"	midrange positive
mf —	black 15"	midrange negative
lf —	black 24"	bass negative
lf +	red 24"	bass positive

When the glue has dried, the overhang around the edges may be either stapled or glued to the rear of the fret. We found that when this was done, the completed fret was a push fit into the front of the baffle. We found it necessary to space the fret out from the baffle board by a small amount to give a clearance to the cross-over unit. We did this using small pieces of scrap wood, glued into the corners of the box.

If desired, the frets may be held more firmly in place using "Velcro", or some other similar fastening system. Remember also, that when the fret is pushed into place, it may subsequently be difficult to remove without causing damage. At least when fitting, put a loop of strong thread around the fret so that you can pull it out easily.

The cabinet is now complete, and the final step in construction is to install the acoustic padding and the driver units. A 6 ft length of 1 ft wide Innerbond is loosely rolled, and glued or stapled into position across the inside of the cabinet between the midrange loading tube and the top of the cabinet.

A 10 ft length of Innerbond should be loosely rolled and glued or stapled across the bottom-back of the cabinet, behind the woofer. A small piece of Innerbond should be placed loosely inside the midrange loading tube.

Using the adhesive backed foam strip supplied, make a gasket around the hole for the bass driver unit. The join in the gasket must be airtight. Then connect the red and black 24" wires from the cross-over to the bass driver unit, making sure that the correct polarity is observed, and fit it into the opening. Insert the four mounting screws, and tighten them firmly and evenly.

The midrange unit can then be connected to its wires, observing the correct polarity (green is positive), and screwed into position. Do not omit the gasket supplied with it, and make sure that the mounting screws are tightened firmly and evenly.

Finally, mount the high frequency unit, again making sure that the connections are made with the correct polarity, and that the three countersunk head mounting screws are fitted firmly and evenly. The cross-over network can be fitted into the edge connector, and its mounting screw and two fibre washers fitted. Your KEF CK3/SK3 (Concerto) system is now complete, and ready for testing.

The extent to which you will be able to test your completed speakers will depend largely on the test equipment which is available. Presumably, you will have a suitable amplifier and program source, such as a turntable. Perhaps the simplest testing which can be done is to A-B test them, using known program sources, such as your favourite records, with another pair of speakers (your old ones?).

With suitable program material, you should be able to hear all three drive units working, each of course in its own frequency range. When bass notes are present, carefully check that the midrange unit is not being "pumped" by back pressure from the bass driver. If this happens, an air leak is indicated from the main enclosure to the midrange isolating compartment. This test is much easier if you have access to a sine wave oscillator (use a frequency of about 40Hz).

Also, while bass notes are being reproduced, feel around all the joints of the cabinet with the palm of your hand, to check for any leaks. The only access into the cabinet should be via the port; any other holes will produce air noises and possible colouration.

During the testing procedure, listen for any rattles and resonances, which could indicate loose components.

If you have access to a source of sine waves, such as a test record or an audio oscillator, as well as a multimeter with good frequency response, it is possible to check that the cross-over is working correctly. Refer to the circuit diagram and curves for details of the network.

In fact, provided appropriate care has been taken, there should be no leaks, no rattles, and no need for apprehension about operation of the cross-over network or the general balance of the system. All you should really need to do is to settle back and enjoy the music, while contemplating the $100 you have saved in the exercise—and the pleasure it has afforded.

A frequency shifter for public address systems

Acoustic feedback is a common fault exhibited by many public address systems, particularly those systems where good installation practice has been ignored. This article briefly describes the precautions to be taken when installing a public address system, and details a frequency shifter to reduce feedback howl and permit the use of more amplifier gain.

by TREVOR BROOK*

Most people are familiar with the howling noise made by public address systems when the gain has been advanced too far or when the microphone is moved too close to an unsuspecting loudspeaker. This effect, known as acoustic feedback, is inevitable in situations where sound energy from the loudspeakers is either radiated directly or reflected back to the microphone position. When the gain of the amplifier is advanced beyond the point where the total system gain at any frequency reaches unity, then oscillations will occur at that frequency.

The complete feedback chain is as shown in Fig. 1. Frequency response unevenness is a result of room resonances and imperfections in both microphone and loudspeaker responses, the highest point in the frequency response determining the frequency at which "howl-round" occurs.

To achieve good performance, one thus uses microphones and loudspeakers with smooth frequency responses and appropriate directional characteristics. Some useful additional gain may also be obtained by positioning the loudspeakers, where possible, away from hard surfaces that could reflect sound into the microphone. These techniques are considered standard practice for public address and sound reinforcement systems, and generally provide acceptable results provided the orator is prepared to remain close to the microphone.

However, acoustic feedback problems can and do arise in situations where the microphone must be placed at a remote location, or where it is impossible to optimise the equipment for a particular application. In addition, on occasions when the gain has to be advanced almost to the howl-round limit a "ringing" effect is to be heard, this being particularly noticeable on speech transients.

Beyond the abovementioned techniques, additional gain may be utilised by fitting a graphic frequency response equaliser into the amplifier chain. This is adjusted to reduce system gain at those frequencies most prone to howling, and to increase the gain at other frequencies. Though a useful increase in gain may be possible this method has the drawback, particularly for music, of spoiling the flat frequency response earlier achieved by good quality microphones and loudspeakers.

*Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG, England.

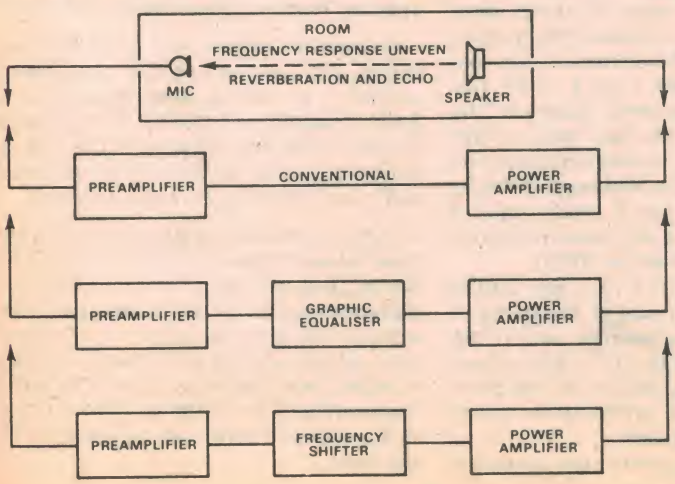


Fig. 1: acoustic feedback chain in typical public address systems.

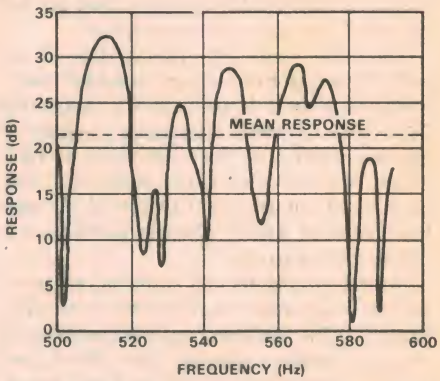


Fig. 2: typical room frequency response curve for a given microphone location.

A typical room frequency response curve for given microphone location is depicted, in part, in Fig. 2. Examination of the curve reveals a pattern of peaks and troughs, with some of the peaks in excess of 10dB above the mean response. Although not indicated in Fig. 2, this pattern of irregular peaks and troughs every few Hertz extends over the whole audio spectrum. Graphic frequency response equalisers, and even tone controls, can provide some correction for the general trends in frequency response, but cannot cope with narrowly spaced irregularities of the type depicted in Fig. 2.

One way of overcoming this problem is to shift the entire spectrum picked up by the microphone by a few Hertz before it is amplified and fed back into the room by the loudspeakers. By so doing, those frequencies which were previously accentuated by room resonances are shifted to new frequencies which correspond to room response minima, at least in theory anyway. Similarly, those frequencies corresponding to room response minima are shifted to new frequencies corresponding to room response maxima.

The effect of this frequency shifting process is to average the room response and allow more gain to be used before instability occurs. In practice, frequency shifting techniques allow between 6 and

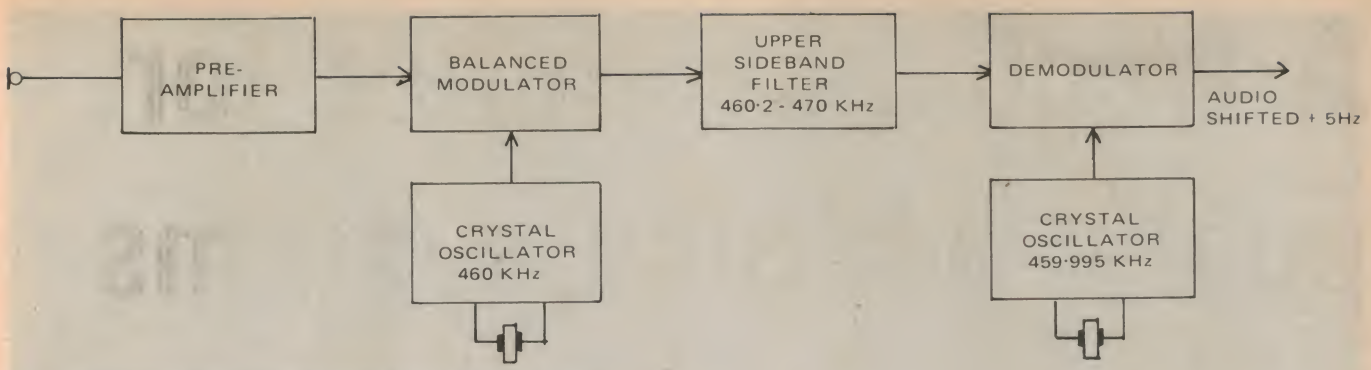


Fig. 3: intermediate frequency method of shifting audio.

8dB more gain to be utilised, and eliminate the ringing effect just before the point of instability. At the eventual howl-round point, an objectionable "warbling" effect is heard as opposed to the usual single frequency oscillation displayed by conventional systems.

Ideally, the frequency shift used should be half the average spacing of room response maxima. In practice though, the frequency shift used is a compromise between, on one hand, perceptibility and, on the other hand, its effectiveness in achieving a useful howl reduction in rooms of various sizes and audio response characteristics. It is immaterial whether the frequency shift used results in a frequency increase or a frequency decrease.

The circuit to be described provides a fixed frequency increase of 5Hz, this figure representing a reasonable compromise between the degree of perceptibility and its effectiveness in rooms of various sizes. In fact, with the unit correctly installed and operated, the audience should remain unaware that any unusual treatment has been applied to the sound.

Until recently, audio frequency shifts were typically produced according to the method shown in Fig. 3. A frequency stable suppressed carrier double sideband signal was first generated at a convenient intermediate frequency, usually in the 450-480kHz region. This was then fed through a filter allowing only one sideband to pass and then demodulated by a carrier re-inserted at a slightly different frequency to give a frequency shifted audio spectrum.

This technique, however, has several inherent performance limitations:

- complex modulator and demodulator circuitry is required in order to achieve better than one percent harmonic distortion;
- frequency response ripple of around 2dB results when using a practical filter design with the stop-band rejection characteristics necessary to prevent beating effects from an unwanted sideband. If the unwanted sideband does leak through it produces, in the output, an audio spectrum shifted in a direction opposite to that required; and
- the slope of the filter must reach maximum attenuation around the carrier frequency, and this causes some inevitable loss of lower frequencies in the wanted sideband.

The design of frequency shifters for audio has been greatly simplified in recent years by the availability of linear integrated circuit multipliers. Fig. 4 shows the basic circuit described here, as developed by Dr M. Hartley Jones at the University of Manchester Institute of Science and Technology.

The basic operational principles of the circuit shown in Fig. 4 are as follows. Two op-amp integrators, IC3 and IC4, are used to derive quadrature sine waves of the shifting frequency (5Hz). These, along with phase shifted versions of the audio input, IC1 and IC2, are fed to two multiplier circuits, IC5 and IC6, and the output added to derive the shifted audio output. We turn now to the circuit details.

The shifting frequency oscillator, IC3 and IC4, consists of two series connected op-amp integrators (741s) with a feedback loop to produce two sine wave outputs accurately in quadrature and of stable amplitude and low distortion.

This oscillator runs at the desired shifting frequency, Δf, as determined by C2, C3, C10, R3, R6 and R9. The zener diodes, along with the preset pot R10, determine the amplitude of oscillation which is chosen so as to remain within the permissible input level range of the multipliers.

Since the two sine wave outputs are in quadrature, these may be represented by the equations $\sin 2\pi\Delta ft$ and $\cos 2\pi\Delta ft$. One of these outputs, $\sin 2\pi\Delta ft$, is fed to the Y+ input of one multiplier (pin 4 MC1495L), and the second output, $\cos 2\pi\Delta ft$, is fed to the other multiplier's Y+ input. Both Y– inputs are returned to DC offset adjustment preset pots, R35 and R40, to facilitate setting the multipliers to zero output voltage under no-signal conditions.

The audio input signal is first applied to IC1 (741), a conventional amplifier, the output of which is passed to IC2 (741), an inverter. The out-of-phase outputs of IC1 and IC2 are then applied to two broadband phase shifting networks, R7, R8, C4 and C5 and R11, R12, C6 and C7. The outputs from these networks, maintained in reasonable quadrature over the audio frequency range, are fed to the X+ inputs of the multipliers (pin 9). Both X– inputs go to DC offset adjustment preset pots, R31 and R38.

Consider a single frequency audio input f. The phase shifter network outputs for this case are $\sin 2\pi ft$ and $\cos 2\pi ft$. These, as the X inputs to the

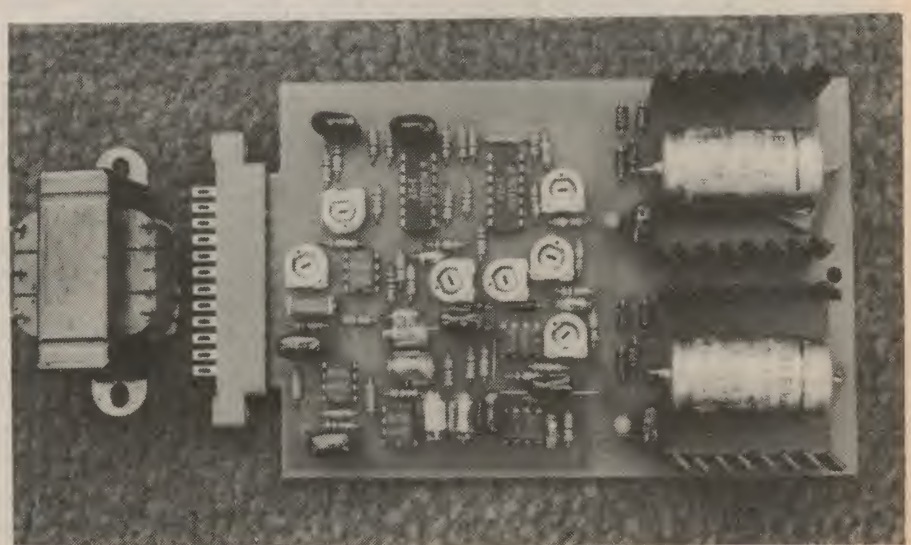


Fig. 5: a pre-assembled shifter module as manufactured by Surrey Electronics.

FREQUENCY SHIFTER

Fig. 6

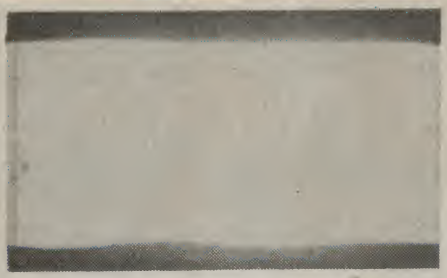


Fig. 7

Fig. 8

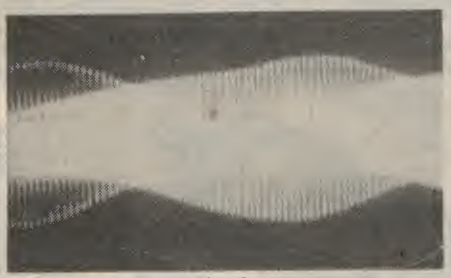


Fig. 9

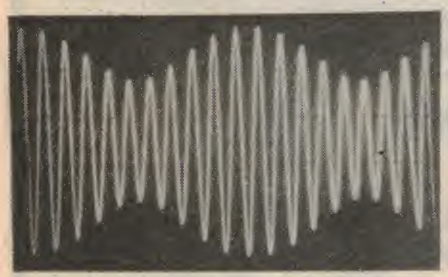


Fig. 10

Fig. 11

multipliers, together with the frequency shifting Y inputs, give the product $\sin 2\pi ft.\cos 2\pi \Delta ft$ at the output of one multiplier (pin14) and the product $\cos 2\pi ft.\sin 2\pi \Delta ft$ at the output (pin 14) of the other. With f = 5Hz and f = 1kHz, these appear at pin 14 of their respective ICs as shown in Fig. 6.

The two outputs are passed through a balance preset potentiometer (R33) and into IC7, arranged as a virtual earth adder with variable gain (R39). This circuit adds the two ouputs $\sin 2\pi ft.\cos 2\pi \Delta ft$ and $\cos 2\pi ft.\sin 2\pi \Delta ft$ together to give the required frequency shifted audio signal $\sin(2\pi ft + 2\pi \Delta ft)$.

If, instead of a frequency increase, a frequency decrease is required, then this may be achieved by swapping the phase shifted audio inputs to the two multipliers ie., swap R7 and R11 and swap R8 and R12. Very natural results have been reported in two channel sound reinforcement systems when using a frequency increase in one channel and a frequency decrease in the other.

The noise level at the output of the shifter is −57dBV, and is determined by the inherent noise of the multiplier ICs. As the overload point is +12dBV, the normal way of operating the device is to include it between the microphone

SPECIFICATIONS

Frequency shift	+5Hz within 1Hz
Frequency response	-1dB 50Hz — 20kHz; -3dB 20Hz —40kHz
Gain	Unity within 0.5dB
Overload point	+ 12dBV (4V RMS)
Noise (20Hz—20kHz, mean reading meter)	−57dBV
Residual 5Hz component in output	−40dBV
Total harmonic distortion at 1kHz	0.1% at +11dBV; 0.01% at −6dBV
Residual amplitude modulation at any level	Less than 0.5 dB p-p 250Hz —3kHz, less than 1dB p-p 220Hz — 12kHz

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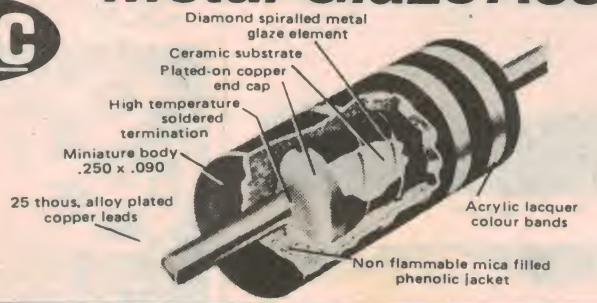

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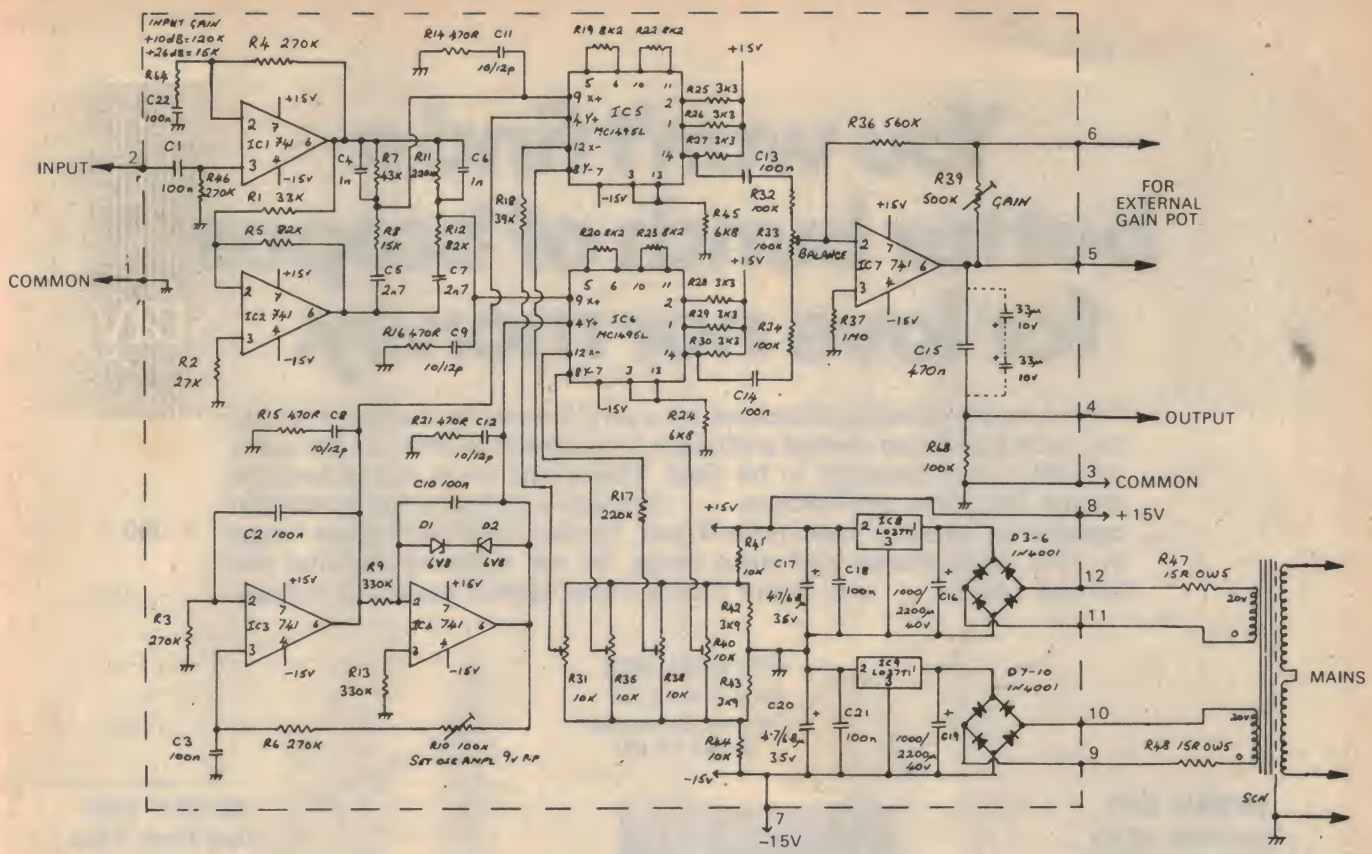

Fig. 4: circuit diagram of the Hartley Jones frequency shifter unit.

preamplifier and the power amplifier. The output signal level of the preamplifier should be such that preamplifier noise slightly exceeds shifter noise. This ensures that the signal to noise ratio of the system is limited only by equipment preceding the shifter.

If it is more convenient to provide extra gain in the shifter itself, this can be done by adding R64 and C22 to reduce the feedback around IC1. Making R64 = 15k raises the gain by 26dB which, in conjunction with a −26dB attenuator at the output, allows the unit to be coupled directly into microphone lines. However, although adequate for public address, the signal to noise ratio will not be particularly outstanding—741's are not exactly the best microphone preamplifiers! Raising the gain by 10dB (R64 = 120k) is generally useful when involved with DIN domestic levels of around 200mV.

Fig. 7 shows the residual modulation placed on a processed 1kHz sine wave signal by the frequency shifting network. This depth of modulation is less than 0.5dB peak to peak, and remains constant at all levels up to the point of clipping where it greatly increases. Fig. 8 shows the output with the shifter well into clipping.

At frequencies lower and higher than 1kHz, the residual modulation performance deteriorates due to departures from exact quadrature of the two audio signals produced by the phase shifting networks. This deterioration is not serious in practice and, for normal applications, does not justify the increased complexity of more accurate phase shifting networks. Fig. 9 shows the treatment of 1kHz square waves, while Figs. 10 and 11 show the performance with sine waves of 100Hz and 20kHz respectively.

The power supply is quite straightforward, consisting of bridge rectifiers and IC regulator (IC8 and IC9) circuitry providing outputs of plus and minus 15 volts. By using a 6VA mains transformer, up to 80mA at plus and minus 15 volts may be taken from the shifter's supply for external use. If it is desired to feed loads as low as 2k ohms without loss of low frequency response, then the output coupling capacitor, C15, should be replaced with two 33uF 10V tantalums.

Alignment of the frequency shifter is fairly straightforward. Below are step by step instructions:

- Clip crocodile lead to output of IC4 (pin 6). Adjust oscillator amplitude to 9V p-p on CRO, or 3V RMS on meter.
- Adjust R31 and R38 for minimum 5Hz at output.
- With 1kHz input, adjust balance pot, R35 and R40 for minimum amplitude modulation of output.
- Adjust gain at 1kHz to unity (or as desired) with gain pot.
- Repeat and check settings.

Sufficient circuit details have been presented to allow those constructors possessing the requisite experience and initiative to build their own units. Normal design practice would dictate that the components be mounted on a PCB, and this is the course we would recommend. Note that the power supply regulator ICs should be mounted on suitable heatsinks.

However, a more convenient course for many readers would be to purchase the shifter unit from Surrey Electronics, England, who manufacture it under a royalty agreement with the University of Manchester Institute of Science and Technology. The unit may be purchased either as a kit of component parts or as a pre-assembled and pre-aligned module, as pictured in Fig. 5. Complete shifter units made up in cases with balanced line inputs and outputs are also available, intended mainly for professional and studio users.

Finally, it must be emphasised that the frequency shifter should be regarded as a useful device in situations where good installation practice has already been followed, but a further increase in gain is required. It should not be used as an excuse to avoid proper planning in the first place.

EDITOR'S NOTE: The frequency shifter described here is not intended as a regular EA constructional project and, as such, no further information will be available through the Information Service. Readers should direct their enquiries to Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG, England.

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Turn and brake lights for a trailer

An inevitable problem for a motorist who acquires a trailer of some kind is the extension of the flasher and brake light functions to the trailer without upsetting their behaviour, or that of any monitoring lamps on the dash board. This simple unit solves all these problems and provides monitoring facilities as well.

*by L. J. STUBBIN

Having recently purchased a boat trailer, and wired up the usual power coupling to provide tail lights, brake lights and flashing direction indicators, several inadequacies of this basic system became apparent:

1. The flashing rate of the turn indicators is slowed drastically, to the point where, in daylight, other drivers could fail to notice that they were operating. Given the right circumstances, this could result in a serious accident.

2. The extra load placed on the flasher relay could lead to premature relay failure, particularly with the trailer attached, which could be extremely hazardous.

3. Although a change in the flashing rate would warn the driver that a flasher lamp had failed, there is no indication of which lamp has failed. It could be either on the car or the trailer.

4. In the author's case, a warning device is fitted to indicate any failure in the brake lights. The extra load of the trailer brake light renders this device valueless, as it is designed to operate with the load of two brake lamps only.

The unit to be described eliminates all of these problems, and is failsafe should any of the transistors fail. If, for example, any transistor goes open circuit, the associated dashboard mounted warning lamp will not light. If TR1 goes short circuit,the associated trailer lamp and warning lamp will be permanently alight, as long as the trailer is connected. Other failure conditions and their indications can be easily deduced by the reader.

The system consists of three identical sections; TR1, TR2, TR3, and an indicating lamp. Each section is operated by one of the three signalling functions; either one of the flasher circuits or the brake light circuit. Each signal is fed to the appropriate TR1 via an isolating resistor, R1.

Each TR1 collector is fed from the car battery, preferably via the ignition switch. Each trailer lamp is supplied from TR1 emitter via R2 and the trailer coupling. The value of R2 is such that with a typical 18 to 21 watt lamp, sufficient voltage is developed across it to switch on TR2 via R3, and in turn TR3 via R4. If the trailer lamp is not of this wattage, the value of R2 must be calculated to develop at least 0.6V when passing the lamp current. TR3 collector is common with TR1 collector and its emitter supplies LP1 direct. Thus the dashboard mounted warning lamp lights each time its associated trailer lamp lights.

The complete unit. TR1, TR4 and TR7 (top of picture) are bolted to the box, which serves as a heatsink.

The unit is built onto a printed board and mounted in a diecast box 4¾" x 3¾" x 2". The circuit board is designed so that the three power transistors may be bolted to one side of the box (for heatsinking) after assembly of the printed board. The assembled board is supported by three bolts, nuts and spacers. The power transistors must be insulated from the box in the usual way, and the mounting holes de-burred to prevent short circuits.

All components other than the warning lamps are mounted on the printed board. The warning lamps are mounted on the car dashboard, but the actual mounting method must be left to the individual constructor. The lamps are connected to any convenient chassis point behind the dashboard.

It is desirable to attach the unit rigidly to the car, normally in the boot, and to this end a pair of mounting brackets should be attached to the box to suit the installation.

Wiring of the unit is fairly straightforward, but coloured hook-up wire will simplify the procedure. The three trailer

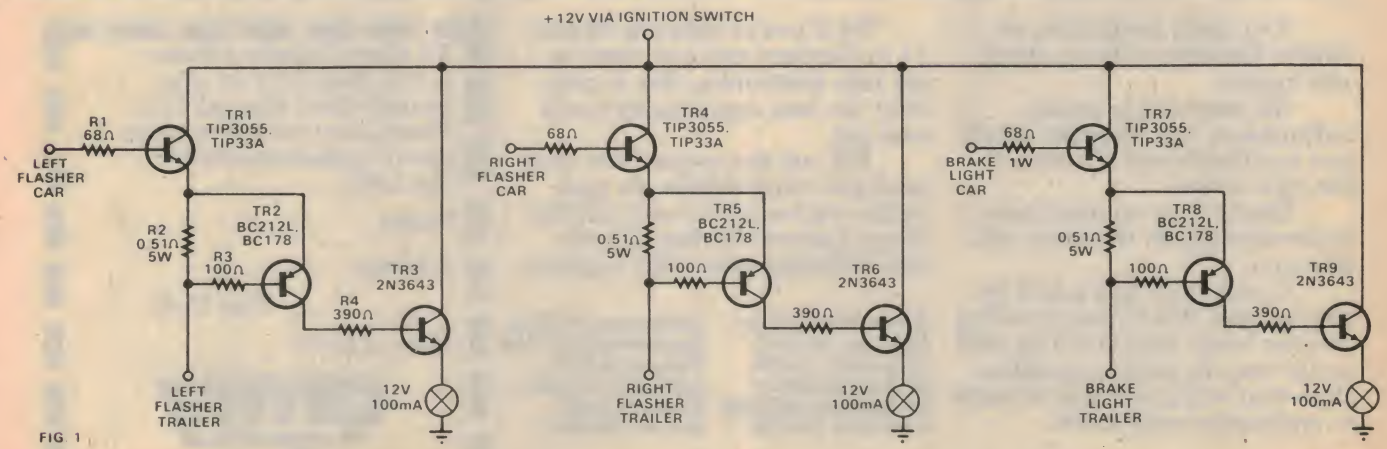

Fig. 1. Circuit of the complete unit. It consists of three identical sections, TR1, TR2, TR3 and an indicating lamp. An alternative arrangement, using a LED indicating lamp, is shown in Fig. 5 and is somewhat simpler.

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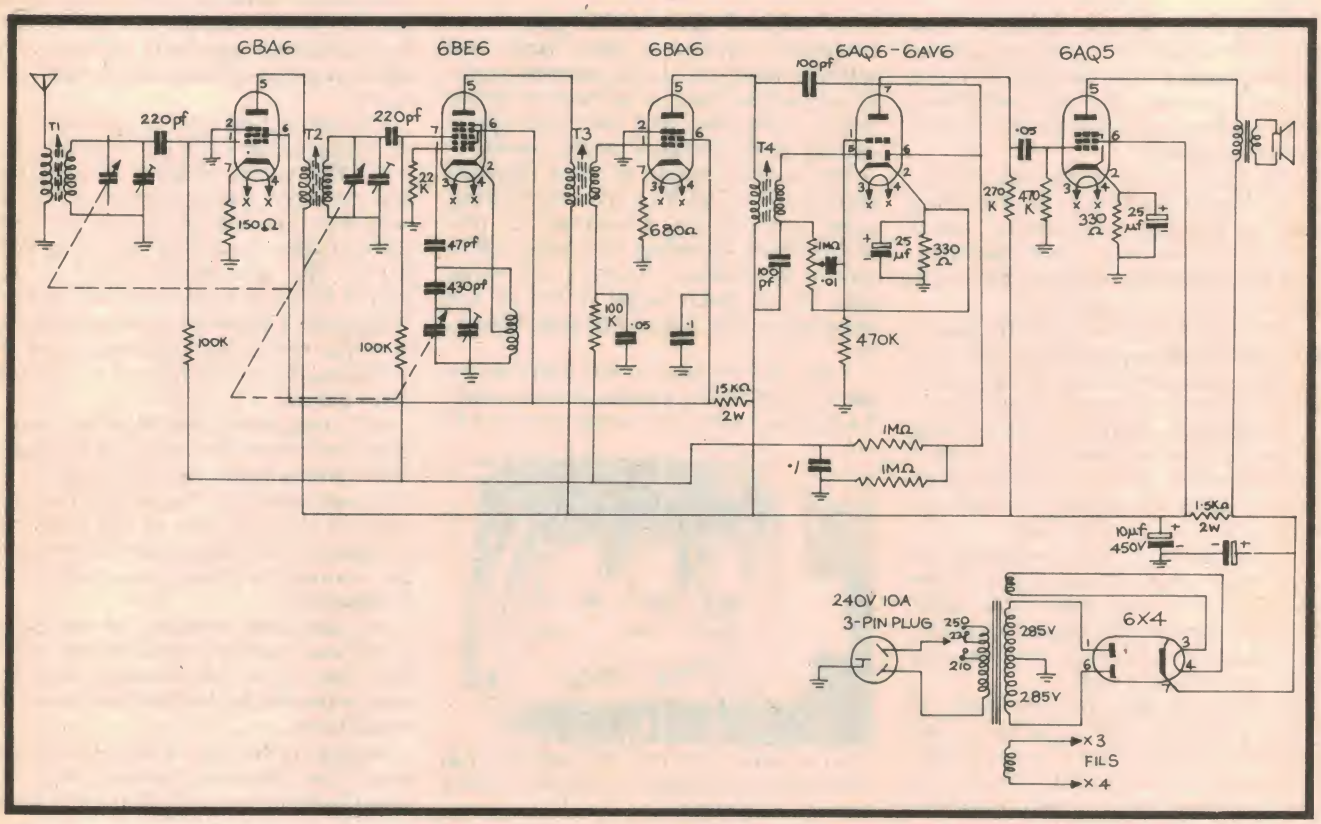

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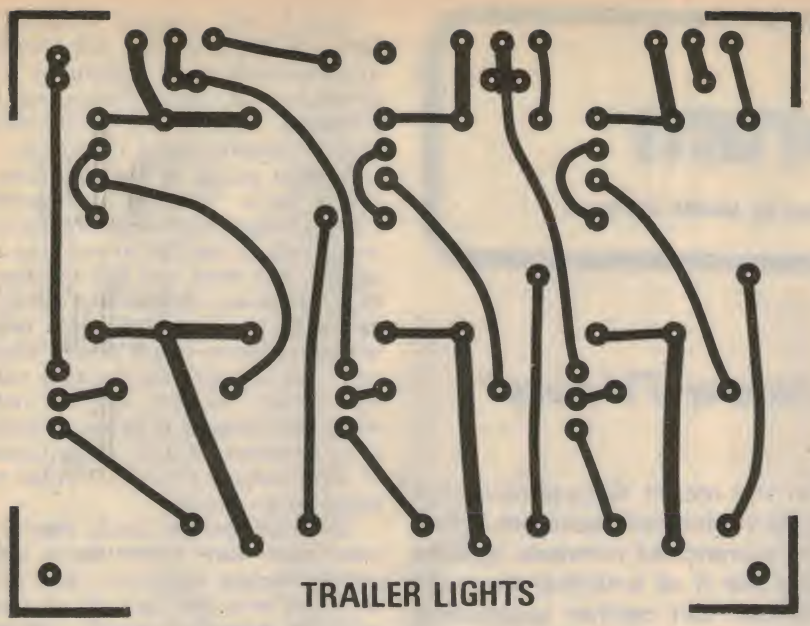

TRAILER LIGHTS

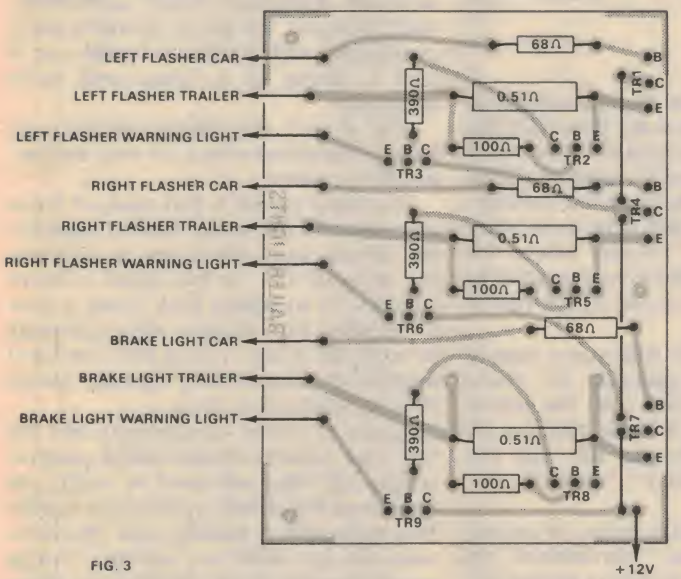

FIG. 3

Above: The printed circuit pattern reproduced full size. Other forms of wiring could be used.

Left: The component layout, seen from the component side of the board. Use of LEDs will reduce the number of parts required. The same board can be used.

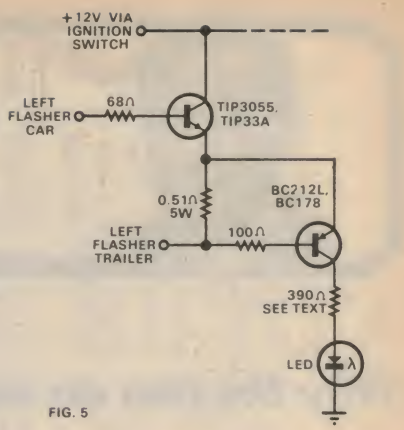

FIG. 5

connections and the main supply lead should be 23/0076 wire or heavier, while the signal and warning lamp leads can be 10/010. The links on the board should also be 23/0076.

The wires should be taken through grommetted holes in the box. The warning lamp wires and the supply wire will have to be routed through the bodywork of the car up to the dashboard for final connection. The signal wires may be connected directly to their respective lamp sockets in the boot. The trailer wires are taken to their respective trailer coupling points.

With the unit completely assembled and fitted to the car, and the trailer connected, it can be tested. Start the engine, reduce speed to idle, switch the headlights on, wet the windscreen, and switch the wipers on. This gives approximately worst case conditions, under which the unit must function normally.

Switch the flashers on while applying the footbrake and check that all trailer lamps and warning lamps operate correctly. Disconnect the trailer coupling and check that no warning lamps light. If any malfunction is found the unit must be carefully checked for wiring mistakes or faulty components.

If desired, LEDs can be used for the warning lamps, at substantial cost savings, since TR3 can be eliminated, the LED being supplied via R4. In this case, R4 will probably have to be reduced in value, to as low as 150 ohms, depending on the LEDs used. Mounting the LEDs is more critical, to ensure good daylight visibility. The authors units uses LEDs.

It will be noticed that one circuit module on the printed board allows for the duplication of R2. This modification covers the possibility of the trailer being fitted with two brake lights. The addition of a second R2 maintains the correct voltage drop across R2 to give correct operation of the unit.

If the circuit operates normally, failure of one brake lamp is indicated by only a momentary flash from the warning lamp when the brakes are actuated. This feature should be checked by removing one trailer brake lamp when testing. If the warning lamp lights normally with only one brake lamp operating, a half watt resistor between 220 and 470 ohms, connected between TR2 base and emitter will be required.

As described, the unit suits 12 volt negative chassis systems. For positive chassis, TR1 = TIP2955, TR2 = BC108 etc., and TR3 = 2N3638A or similar. The unit has not been tried on 6 volts.

Metal case transistors are not recommended for this unit, since they would have to be mounted outside the case with the attendant risks of short circuits. Note also that Motorola power transistor pin connections are the reverse of the Texas types specified.

PARTS LIST

1 Diecast box, 4¾in x 3¾in x 2in
1 Printed board
3 TIP3055, TIP33A
3 BC178, BC212L
3 2N3643
RESISTORS
3 68 ohms, ½ watt for flashers, 1 watt for brakes
3 0.51 ohm, 5 watt
3 100 ohms, ½ watt
3 390 ohms, ½ watt
3 12 V, 100 mA bezel lamps
Mounting lugs
Grommets
23/0076 hook-up wire
10/010 hook-up wire
Bolts, nuts, spacers etc.

PLEASE NOTE

This project is one contributed to our Kitsets-EA Competition. As such, it has not been through our laboratory and should not be regarded as a regular "Electronics Australia" project. We will therefore not be in a position to answer postal queries about its operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributor's name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

Forum

Conducted by Neville Williams

Why the ban on some colour TV sets?

There has been more heat than light in the recent discussion about the banning of certain transformerless colour television receivers. It has been interpreted as a defensive ploy by entrenched interests against further partitioning of the market. Others see it as a stick-in-the-mud attitude by Australian Electricity authorities, but neither suggestion squares with the facts.

The whole affair can, indeed, be reduced to purely technical considerations—but they have to be separated out from emotions that are as recent as the colour TV tariff inquiries, and as ancient as the early AC/DC receivers.

Even the word "transformerless" has an emotive quality far beyond its technical significance. I'm one of its victims!

There was a time when the mains supply to many buildings and many homes was 240V DC. As a young man, I can remember working on those early DC and AC/DC receivers with their series heater strings, a large dropping resistor, or barretter tube, and that vicious arc-happy supply running straight into the circuitry, with one side connected directly to chassis.

How we hated working on them. We'd clear the wooden test bench and perch on a wooden stool with feet tucked into the wooden rungs.

But, just when transformerless sets might have been forgotten, a new generation of factory testers and servicemen were faced with the same old problem in a different guise—valve battery/mains portables involving a direct connection to the supply line. With their frail valves and skimped design the sets needed more than their share of attention and, for the unwary serviceman, they had a bite like an alligator!

It was in about this same era that one of the then major local TV manufacturers released a transformerless TV receiver —notable because just about everyone else was following conventional local practice.

Servicemen and others were quick to condemn the move as retrograde and dangerous, both for themselves and for users who might conceivably come in contact with the internal metalwork—and the mains!

The supply authorities didn't like them either but they could scarcely object to them on safety grounds, provided the cabinet and the peripherals effectively isolated the user from the internal circuitry. In fact, a properly designed transformerless receiver would have to be safer than a radiator or a toaster, where the element usually remains accessable to prying fingers, or a spoon in the hands of a tiny tot.

There was a hassle with some supply authorities about a possible DC component being fed back into the mains but, for the industry at large, this was an academic point. The real rub was the allegedly "nasty", "risky", "clumsy", circuitry.

As for other television receiver manufacturers, it was "convenient" to have a competitor's products sniped at.

Overseas, transformerless designs continued to be as much the rule as the exception but, then, foreigners are such peculiar people! Englishmen carry furled umbrellas; Germans make up huge words, and so on. If they chose to tolerate transformerless circuitry, that was their funeral!

Speaking of funerals, I am not aware of any fatality in Australia, to either a serviceman or a user, resulting from a transformerless TV receiver. But the emotive quality is still there, not far below the surface. I didn't like them in my younger days; I still don't like them. And neither do a lot of other people!

However, with the arrival of colour television, various aspects have had to be evaluated afresh. A colour TV receiver draws significantly more power than its monochrome counterpart and, particularly these days, substantially rated power transformers are a costly item. They add weight to already heavy receivers and, no less important, their radiation field can upset the behaviour of colour picture tubes.

Despite this, various manufacturers here and overseas have still settled for a conventional mains transformer on the grounds that, notwithstanding their problems, they do represent a reliable and convenient source of voltage.

Another group of manufacturers has opted for a "half-way" compromise. Using a bridge, they rectify the incoming mains voltage directly to produce a DC supply, and then use this to power a high frequency solid-state converter, operating in conjunction with what is virtually a ferrite cored power transformer. This provides the requisite voltage and current for the receiver proper, while also isolating the relevant circuitry from the mains. It is an elegant scheme in some ways but it does involve more things to go wrong!

The third group? Well, they're the ones who have opted for a simple, transformerless approach, and they're the ones who are currently in trouble with the Australian supply authorities. And, strangely, the group includes some prestigious and expensive brands—so it isn't a matter of a cheap and nasty approach.

And it isn't the matter of the sets being transformerless in the earlier, emotive context.

The real problem is that many of these receivers use half-wave rectifiers operating directly from the mains to produce the requisite DC for the actual receiver circuitry. In so doing, they cause a flow of rectified AC (virtually direct current) through the mains wiring and the local distribution transformer, typically about three-quarters of an amp.

Because of wiring conventions and the fact that most receivers use a positive supply rail, they will tend to rectify (or load) a particular half-cycle of the supply. The asymmetric loading will therefore tend to be additive, making things uncomfortable for the distribution transformers, which would tend to saturate magnetically sooner than would otherwise be the case.

That is disturbing enough but there is more to come. The flow of direct current along the neutral line raises the potential of the line above the ground by the product of current times resistance. This in generally regarded as undesirable in itself but it can lead to localised problems if the neutral is accidently grounded at an isolated point in the system.

In Australia, supply authorities tend to favour the alternative MEN (multiple earth neutral) system, whereby the neutral line is grounded at the point where it enters customer's premises. This minimises IR drop, and keeps the neutral line very close to earth potential throughout the entire network.

But it also means that current normally carried by the neutral line is shared by the parallel earth path—a random mixture of water pipes, gas pipes, telephone and power cable sheathing, and the ground itself. As long as the current flowing through this parallel path is AC, no

special difficulties arise but, if there is a DC component, it produces electrolysis in the metal/earth interface, hastening corrosion by an alarming degree.

In Sydney, the Water Board has nominated a figure of 10 millivolts as the maximum potential difference they are prepared to tolerate between their pipes and the surrounding earth. Above this, electrolysis can make a significant difference to the service life of buried pipes. How does this figure relate to the possible effects of transformerless TV sets using half-wave rectifiers?

Some have argued that the DC effect of the suspect receivers was much less than the load current and that only a small portion of it travelled via the earth path. In fact, it would appear that the total DC load of such a receiver flows through the mains and, with overhead wiring in particular, most of it travels via the earth path rather than via the neutral conductor.

Seeking a positive answer, electricity supply authorities in Sydney made up thirty black boxes simulating the load of suspect TV receivers and installed them in customer's homes in various districts and in a likely distribution density. They then measured the potential of the service pipes in relation to ground, with rather disturbing results—a potential difference in some cases of up to 300mV, or thirty times the maximum figure set by the Water Board!

If the current were to flow uniformly through and from metal structures, it would not be quite so bad but, in fact, it tends to find paths of lowest resistance and to concentrate along those paths. Under worst case conditions—say amps of direct current flowing from a large block of home units—the concentration could cause intolerable corrosion at specific points on underground pipes within a matter of months.

In the magazine "The Contractor" published by the Sydney County Council, it is claimed that one ampere of direct current discharging from an underground metal structure can remove approximately 9kg of iron or 34kg of lead, in a year. Whose iron and whose lead is anybody's guess, because current flowing through underground pipes and structures is no respector of premises! A's TV receiver may damage his own pipes, or B's or C's.

It is against this background that various supply authorities made representations to the Australian Government to restrain the importation or manufacture of transformerless receivers using half-way rectifiers—not because they were merely transformerless, or unsafe to users, but because they were likely to produce damage by electrolysis. And the figures certainly support this contention: one survey that I know of, carried out by a prospective importer, turned up DC components from a variety of European receivers ranging from 720-850mA.

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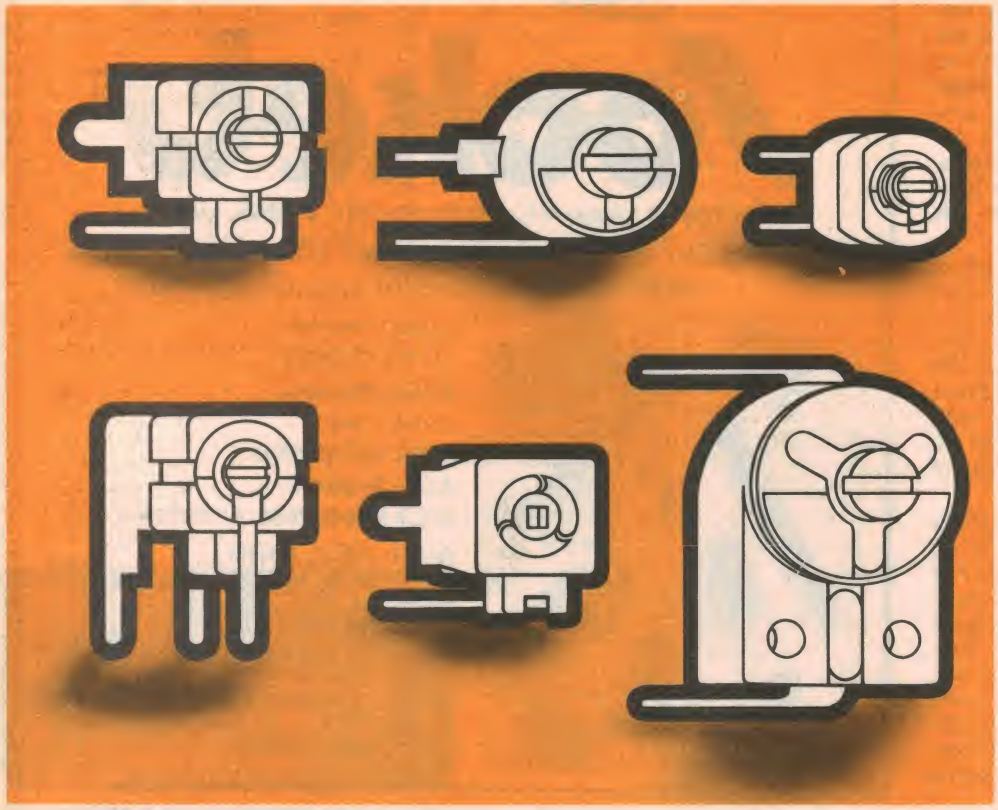

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FORUM

As I mentioned earlier, all this has to do with technical design. If there are implications and overtones related to safety or marketing, they are incidental and emotive.

There's that word again!

If I'd had any doubt on its relevance they would have been dispelled by a question posed in Parliament by Mr. U. E. Innes, who reportedly asked: "if the Government would take steps to recall overseas colour television sets which proved dangerous when operated in Australia".

Whatever Mr. Innes understood by the word "dangerous", and whatever the then Minister for Science, Mr. Morrison, meant in repeating it, I venture to suggest that the public interpreted it as a hazard to their own safety. That same evening I was rung twice by a major newspaper, seeking clarification for the sake of readers who might be at risk using the particular brand.

I have an idea that my rather prosaic explanation of half-wave rectifiers, DC earth current and corroded pipes came as something of an anti-climax, however inconvenient such situations may be in the longer term.

But, leaving politicians and newspapers to their own devices, I did encounter a number of interesting observations which are worth noting:

● Some authorities were actively concerned with the DC effect of early monochrome TV sets but they were prepared to accept up to 100mA per set. The figure still stands but it is of little help with the present-day problem receivers.

● Certain authorities are adopting a harder line now than previously because they have changed over, in the meantime, from an independent neutral to the MEN system.

● While Australian supply authorities are particularly concerned about simple transformerless half-wave systems, they will not accept half-wave voltage doublers either. These do load both halves of the input cycle, but not symmetrically, so that an unacceptable DC effect is still likely to be present.

● A TV receiver—or any other device—which sets up an unacceptable DC effect in the supply mains can be rejected by supply authorities, irrespective of age, source or brand. People who have bought unacceptable colour TV receivers may therefore be faced with embarrassing confrontations with the supply authorities and/or distributor.

The supply authorities have been specially exercised about new colour television receivers, partly because they represent a wave of new equipment, and partly because there seems to have been a tacit assumption that imported monochrome receivers draw so little current and are so few in number that they are hardly worth bothering about. To my mind both assumptions are suspect and any query about transformerless half-wave TV sets should apply to all sets, whether colour or monochrome.

Two major questions arise from all this. The first: "Why is a practice, acceptable in Europe and elsewhere, unacceptable in Australia?"

One factor seems to be that, with the common use overseas of non-polarised plugs and/or less rigid wiring conventions, transformerless receivers are more likely to be connected to the mains in random polarity, so that the DC effects may tend to cancel rather than to add. This, coupled with independent neutral wiring has, historically, diminished the apparent magnitude of the problem.

I gather, however, that some European supply authorities have been disturbed by the Australian research into underground corrosion effects. It could lead to local research and a harder line in some countries.

Finally, there is the problem of what to do about a colour receiver that is a candidate for banning by local supply authorities.

The standard answer is to purchase a 240/240V isolating transformer and use it between the receiver and the power point. Although the combination will still present a non-symmetrical load to the mains, the DC effect will be eliminated. It sounds like an easy answer—until you go looking for such a transformer!

First off, the transformer would almost certainly have to be positioned outside the receiver cabinet. As a free-standing unit, it would be subject to rigid (and costly) specifications covering input and output connections, physical construction and primary/secondary insulation.

But that is not all. While the DC effect is isolated from the mains, it is concentrated instead in the secondary of the transformer. As a result, while a full-size solid-state colour receiver may represent a load of less than 200W, the flow of about 700mA DC through the primary would cause so much core saturation that something like a 750W transformer would be necessary.

And a 750W 240/240V isolating transformer, meeting official specifications, is very large, very heavy and very expensive: typically between $80 and $100.

It may be possible to dream up some other way around the problem which would not necessitate substantial modification to the receiver proper. We would certainly hope so.

All told, people who have bought unacceptable colour receivers are in an unenviable position. It will be interesting to see whether the supply authorities close a blind eye to those that came in before the floodgates were closed. If they don't, and if users are faced with a bill for $100, there could be a legal situation centring on whether receivers were sold in Australia in defiance or neglect of standing regulations about the DC component fed back on to the mains.

A nasty situation indeed.

NOVUS 4510 MATHEMATICAL CALCULATOR

Features Reverse Polish Notation, 3 level stack plus separate accumulating memory 8 digit display Logs antilogs, sine, cos, tan etc., square root, squares, pi, reciprocals. We can't do it justice here so call in and see one or check page 59 of our new Catalogue

NEW LOWER PRICE does not include NI-CAD batt

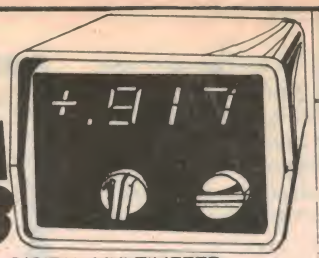
$59.95

SPECIAL TAX FREE PRICE $54.00 (pp12½c)

4515 Programable $99.95 Includes NI-CAD Batt & Recharger (a drop of $46.00)

TAX FREE PRICE (BABE) $89.00

LM-3



DIGITAL MULTIMETER

Full three digits. Less than 2" high. Automatic zeroing. Automatic polarity. Battery powered. Including MOS/LSI charger construction. Low, low price. Drop-proof.

$113.85 p&p $2.00

TAX FREE PRICE $99.00

SONY SPECIAL

Compact 18" VHF/UHF Trinitron Colour TV

The KV-1800AS from Sony, being full PAL and incorporating the world famous Trinitron colour system, always brings you the highest quality colour pictures that are truly enjoyable to watch. It is also designed to comply with the Australian Broadcasting Control Board's Recommended Standard for Colour Television Receivers and the Australian Standard AS3159 with regards to safety. If you want a colour TV that gives you full colour enjoyment with simple and easy operation, the KV-1800AS will be the wisest choice

- **All solid-state circuitry** including ICs for highly reliable quality performance over many years
- **Built-in Automatic Colour Control circuits** for the best colour without troublesome colour adjustments
- **AFT (Automatic Fine Tuning)**: No need for tuning adjustments when changing channels.
- **Vertically straight cylindrical screen** effectively prevents annoying light reflections.
- **Easy to use** with well-arranged controls on the front
- **Convenient VHF/UHF selecting button** to make channel selection simpler.
- **Compact easily-movable walnut-finished cabinet** with wide 18" screen ideal for family viewing

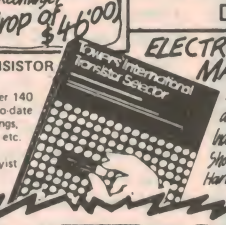
NORMAL PRICE $679.00

OUR SPECIAL PRICE $609 + $30 service

SENT FREIGHT ON

TOWERS' INTERNATIONAL TRANSISTOR SELECTOR. (T. D. Towers)

Our latest data book from Foulsham has over 140 pages of computer listing (for the most up-to-date print out!) of over 10,000 transistors – ratings, characteristics, identification, manufacturer etc. UK listing with addresses CV numbers etc. Essential for the professional or keen hobbyist at $11.25



ELECTRONICS CIRCUITS MANUAL by John Markus

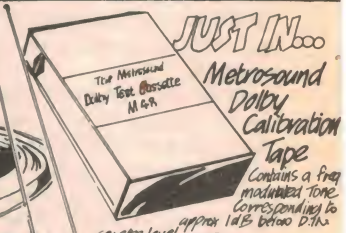
Over 3000 advanced circuit designs indexed for quick ref. Just short of 1000 pages in Hardback form $27.50 $2.00

Large 6in heavy duty 8W flush-mount speakers with chrome grill Ideal for vehicle door or rear shelf mounting. Also ideal for home use in ceiling etc. Big ferrite magnet, 100 - 10kHz response 4 ohm. Only requires 2¼ in space

ONLY $12.00

SAVE $6.00

(P&P $1.00)



JUST IN... Metrosound Dolby Calibration Tape

Contains a freq modulated tone corresponding to cassette level approx 1dB below D.T.L.

$7.25 p&p

KITS

See E.A. Dec 73

200MHz COUNTER KIT

Special purchase of components enables us to **REDUCE** the price of this kit. Presented in two stages.

Basic 20MHz Canter has 4½ decade LED readout with leading zero suppression. Crystal timebase for self calibration or ext. cal. 1M/50pf input impedance and 50mV to 10V rms sensitivity. There can't be a better, cheaper instrument anywhere. Now reduced to

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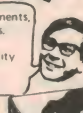
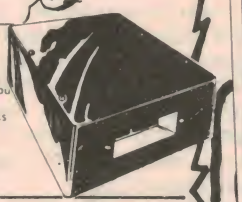
200MHz Prescaler extends the capability of the basic 20MHz by a factor of ten. Well worth buying the complete kit for just

$120.00

NOTE: All our kits use top quality components, where possible to the specs. given in articles. Occasionally we are forced to substitute alternative components because of availability problems, but these are checked out with magazines concerned



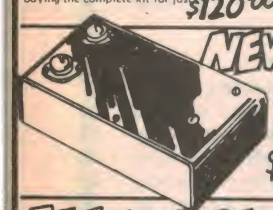
See E.T. May 75



KIT 79 ET702 Radar Intruder Alarm
Uses microwaves to detect movement within 10M range by the Doppler principle. Now you can build a unit that operates on the same principle as the professionals use. Even works through timber and plastic wall panels and screens!! Operates from mains or batteries (extra). Complete kit $54.00 (p&p $1.00) CL B960 Radar module $32.00 (p&p $1.00) ET702 PCB $1.75

DON'T FORGET OUR AMP KITS
Playmaster 143 $69.90 ET1422 $118.00 (no rear panels now)

KIT 56 High Power Strobe (E.T. Aug 71/25 Top Projects) Ideal for parties, dances etc. to create dazzling effects. Uses large 7" satin finish reflector exactly to original specs. Single tube can easily be converted for 2 tube operation. Don't confuse with cheap, less powerful units. Now only $22.50 (p&p $1.00) Strobe Caps 6.5 uf 250V a.c. $3.50 each.



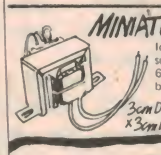
NEW C.D.I KIT (See E.A. July 75)

The only kit with a PRE-PUNCHED HEAVY DUTY ALUMINIUM BOX (saves a lot of hard work!!!). We also give you a prewound secondary to simplify Transformer winding.....Transistor sockets for easy servicing. Build it & fit it in an evening. HURRY we anticipate tremendous demand at

$22.50 p&p $1.00

KIT including Heavy Duty Ducon Capacitor $26.00 p&p $1.00

MINIATURE TRANSFORMER



Ideal for small transistor power supply etc. (P/S will give either 6 or 9 volt output) Special insulation between primary & secondary

3cm D x 6W only x 3cm D approx $2.75

100 only available

27 MHz BASE AERIAL. High-gain base loaded Vertical DSE-GP. This magnificent aerial with an overall height of 18 ft features a gain of 4 DB. The matching stub places it at D.C. ground potential which substantially lowers the residual noise level and results in gains as high as 19 DB in signal to noise ratio $59.00 road freight extra

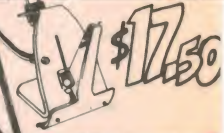
CENTRE LOADED ROOF ANTENNA
Only 18in high but works as well as a full quarter wave of 108in. All parts chrome plated on brass or stainless steel, spring included & supplied with coax cable & connector

p&p $1.00 $19.50

BE ON THE LEVEL!

Make sure your Hi-fi, Stereo, Display Turntables, Scales, Machine Tools etc are horizontal with this Bulls Eye Level $1.90

311 CENTRE LOADED GUTTER CLIP ANTENNA
Clips on the rain gutter of any vehicle. Can be installed or removed instantly without tools!! 18in high & supplied with coax & plug



$17.50

G.F.A. CENTRE LOADED TRUNK MOUNT FIBRE GLASS ANTENNA
Ideal long range antenna for the person who does not wish to drill holes in his vehicle, simply clamps to boot or bonnet lip 48in long & supplied complete with coax & plug

$27.00

MODEL FS-30 15 Watt SOLDERING IRON
This fantastic little iron operates from any 12 volt AC or DC source (car battery or 12 volt 1.2 amp Transformer. Complete with plated tip, & 9ft lead. Ideal for Transistor servicing & general home repairs

$3.90 p&p 50c

WHY PAY $10?

CIGARETTE LIGHTER PLUG to suit 50c

SPARE TIP to suit 50c

NEW LOWER PRICES FOR OUR DIGITAL CLOCK KIT (over 1500 sold)

Our huge purchasing power enables us to REDUCE our prices yet again!!

4 Digit Clock $19.95

6 Digit Clock $24.90

p&p $1.25

Attractive Case see next column $8.50

SEE E.A. APR'L

BUY NOW IN STOCK, BUT ONLY A FURTHER 500 AVAILABLE!

QC-8 QUARTZ CRYSTAL MODULE KIT
Complete with 3mHz crystal & divider IC – gives 50 cycle output to operate virtually any digital clock. Takes only 10 minutes to build – highly accurate (within seconds a month). Operates on 9 to 15 volts D.C. $12.50 p&p 50c

Yes with the above module your Dick Smith clock will operate in your car, boat or plane at chronometer standards.

If you are running your clock off 240V A.C. and would like it to continue to operate for up to 48 hours when the power fails, simply use the module with a 9 volt transistor radio battery. It will change over automatically.

Full details in September E.A. or send S.A.E.

MINIDRILL

PC drill runs off 4 UM3 cells or 6V dc at 600mA runs at 2500 rpm drilling holes from 0.0236 to 0.059". Ideal for all PC drilling, model makers, jewellers. This is a new line at $15.75 (P & P 75c)

AND NOW! $10-50 MINI DRILL STAND make your own mini STAND DRILL

$8.50 p&p 75c

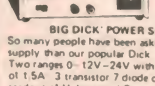
FANTASTIC LITTLE MULTI-METER EXTENSION LEADS

allows you to connect your meter probes to any circuit with alligator clips. PAIR RED & BLACK 60c

ATTRACTIVE NEW CASE for our Digital Clock Kit

p&p 75c

$8.50



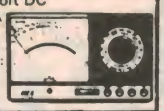
BIG DICK' POWER SUPPLY
So many people have been asking for a bigger supply than our popular Dick. So here it is. Two ranges 0-12V-24V with a max. current of 1.5A. 3 transistor 7 diode circuit with meter readout of Voltage and Current. Voltage selector and variable control. Measures 18.5 x 10.5 x 8.5 cm weighs 1.5 kg (it's that well made!!! Specially designed for instrument supply and the service bench. Fully regulated. Simply connect leads directly into Big Dick or mount and connect terminals supplied. Value at $39.50 (p&p $3.00)

See you at stand 89, FREE Exhibition

MULTIMETERS

LT101
Beginners, 1K/V, safety "off" position. Ranges Vdc 0-10-50-250-1kV: Vac 0-10-50-250-1kV: Idc 0-1-100mA: Ohm 0-150K.
$8.90 (P & P $1.00)

LT601 20K ohms/Volt DC
Top value, 15 range, 50uA movement. Ranges Vdc 0-5-25-50-250-500-2.5kV: Vac 0-10-50-100-500-1kV: Idc 0-50u-2.5-250mA: Ohms 0-50K-5M.
$13.50 (P &P $1.00)



C7202EN 20K ohms/Volt DC
24 ranges, 35uA, off posn. Ranges Vdc 0-2.5-10-50-250 Vac 0-10-50-250-500-1kv Idc 0-50u-5-50-500mA: Ohms 0-10-100K-1-10M.
125x90x40
$15.50
P&P $1.50

C7201EN
20-K/Vd.c. Capacitance Mirror scale. Ranges Vdc 0-5-25-50-250-500-1K-2.5kV: Vac 0 10-50-100-500-1kV: Idc 0-50u-2.5-250mA: Ohms 0-6K-6M: Cap 10pF to 0.1uF.
150x110x50
$19.50
P&P $1.50

C7081GND 50Kohms/Volts DC
16uA, 46 ranges doubler mirror scale protected. Ranges Vdc 0-0.5-2.5-10-50-250-1K: Vac 0-3-10-50-250-1kV: Adc 0-50u-5-50-500mA-10A: Ohms 0-16-160K-1.6-16M. Note all these ranges may be halved by VA/2 switch.
165x118x60
$29.75
P&P $1.50

HT100B4
Overload protection 9.5uA movement 10A a.c. & d.c. 100K/V sens. Shockproof mech. Ranges Vdc 0-0.5-2.5-10-50-250-500-1kV: Vac. 0-2.5-10-50-250-1kV: Idc 0-10-250uA 2.5-25-250mA-10A. Aac 0-10A, Ohms 0-20-200K-2-20M.
180x130x80
$42.00
P&P $2.00

360TR 100K ohms/Volt DC
Transistor checker/multimeter, 34 ranges, 5"mirror scale, 8.5uA. 10A a.c. & d.c. Hfe to 500 ranges Vdc 0-0.5-2.5-10-50-250-1kV: Vac 0-5-10-50-250-1kV: Adc 0-10-25-500uA-5-50-500mA-10A: Iac 0-10A. Ohms 0-5-50k-5-50M.
180x135x85
$45.00
P&P $2.00

150FET METER
11M d.c. input, direct peak to peak reading on AC. 21 ranges, transistor bias measurement. Ranges Vdc 0-0.25-1-2.5-25-100-250-1kV: Vac 0-2.5-25-250-1kV and p-po-7-70-700-2800V: Adc 0-25-250uA-2.5-25-250mA: Ohms 0-5-50K-5-50M-50ohm-5-50K.
160x110x50
$57.50
P&P $2.00

MITSUI SIGNAL INJECTOR

Handy service aid. Transistorised. Operates well into H.F. band. Simply prod into circuit from output stage forward to locate fault. Complete with 1.5V battery.
160x10dia
$8.75 P&P 30c

MITSUI SIGNAL GENERATOR

Ideal for beginners. Aligns IF's and broadcast band. Covers 400-550 kHz for IFS and 550-1600kHz broadcast band. Excellent value.
125x60x40
$9.95
P&P 75c

SE360 Sig Injector/Tracer

Deluxe instrument for TV, AM &.FM, Audio, servicing etc. Meter or audio readout. Output for VM or Scope. CAlibrated VU meter. Built-in injector Sig frequency 1kHz 0-5V: Gain 60db: Input Z 75k: Output 8 or 600 ohm: Meter 200 uA V.U: Speaker 2¼":
Power 9V
155x85x65
$38.00
P&P $1.00

TE20D R,F, Sig Gen

Dual r.f.output terminals Separate Audio control. Crystal socket for calibrator. Range 120kHz to 500MHz : Accuracy 2% : Modulation 400Hz: Audio output 8V: 240V operated Variable RF attenuator.
140x215x170
$55.00
P&P $2.00

TE22D Audio Gen

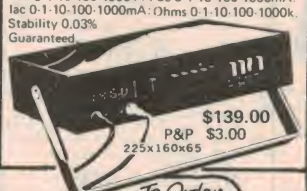
High accuracy at low price. Sine and Square wave outputs frequency range 20Hz to 200kHz (Sine), 20Hz to 30kHz (square) : Response ± 1½ db : Output 1k., 7Vrms sine, 7V p-p square Distortion 2%: Accuracy 5%:
215x170x140
$64.00
P&P $2.00

ENGINE ANALYSER

Versatile, checks performance, tuning etc. on 4, 6, 8 cyl. engines. Ranges: RPM 0-1200-6000 : VO-3-15-30 : Ohms 0-100k : Diode test : Dwell 0-45°-60°-90° : I 0-90A : Spark : Capacitor test 4" movement. With leads and current shunt.
180x130x80
$49.00
P&P $2.00

SINCLAIR D.V.M.

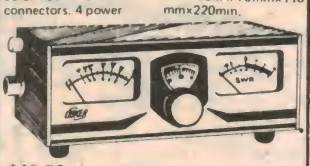
Lowest price digital Multimeter. 3½ digit. Dual Slope. Auto polarity 60hr battery operated MOS, LSI. Ranges Vdc 0-1-10-100-100V: Vac 0-1-10-100-1000V: I dc 0-1-10-100-1000mA: Iac 0-1-10-100-1000mA: Ohms 0-1-10-100-1000k. Stability 0.03% Guaranteed.



$139.00
P&P $3.00
225x160x65

SWR/Power meter SWR 200

Professional through line. 3MHz to 200MHz. 50 or 75ohm UHF connectors. 4 power ranges 0 2 20 200W 2kW Calibration chart supplied. VSWR 1:1 to 1:10 and infinity Movement 95uA. 76mmx110 mmx220mm.



$48.50
P&P $1.00

SWR3 SWR Meter

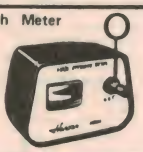
Handy for Tx alignment with built in field strength meter. 5% accuracy 50ohm impedance. 100uA movement. 5 section telescopic antenna 145x50x60mm.
$15.00
P&P $1.00

FS5 SWR/Power Meter

Compact yet measures SWR and power at once. Power 0-10-100W:SWR 1:1 to 1:3. Frequency response 3MHz to 150 MHz. 50 or 75ohm impedance. 160x85x 98mm.
$29.50
P&P $1.50

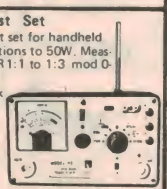
FS1 Field Strength Meter

Simple low cost instrument for field checks. Covers 2 to 200 MHz. Ideal AM, Marine, VHF unit. Requires no tuning.
$7.90
P&P 75c



FS117 27MHz Test Set

Multipurpose 27MHz test set for handheld walkie talkies & base stations to 50W. Measures Power to 5W:VSWR 1:1 to 1:3 mod 0-100% : Field strength : Generates 27MHz for Rx alignment : checks crystals : modulated 27MHz generator : 1000 Hz audio output : 5W dummy load With telescopic antenna, leads etc.
180x115x80
$49.50
P&P $1.50



TE15 Grid Dip Meter

Transistorised. Operates as G.D.O., Absorption wavemeter, oscillating detector. Frequency range 440kHz to 280 MHz : 6 coils : 500 uA movement : 9V battery operated : 180x80x 40mm.
$41.50
P&P $1.00

WB200 Grid Dip Meter

FET transistorised. Professional instrument with no spurious dips. Operates from 400kHz to 200MHz in 7 bands. Tone modulation. AF output. High accuracy and stability. Ideal parasitic sniffer, Wavemeter Sig gen etc. etc.
165x75x85
$142.00
P&P $1.75

'BIG DICK' Power Supply

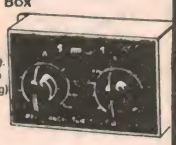
Two ranges 0-12V-24V with max current of 1.5A. 3 transistor 7 diode circuit with meter readout of Voltage & Current. Voltage selector & variable control. Designed for instrument supply & the service bench. Fully regulated. Connect leads directly into Big Dick or mount & connect terminals supplied. 185x105x85mm
$39.50 (p&p $3.00)

TH71 Transistor Tester

Simple to use NPN and PNP. Ranges Hfe 0-100 500 at Ib of 50uA and Vce. of 6V. Lamp indicates faulty devices. Big scale movement. Battery operated.
180x115x80
$26.50
P&P $1.50

J1194 R/C Sub Box J1194

12 steps in 2 ranges Resistance. 15ohm to 10k and 15k to 10 Meg. Capacitance: 0.0001 to 0.22 uF (600V working) Handy unit for experimenters.
130x70x65
$7.50
P&P 75c



TC2 Valve Tester

Checks shorts, open circuits, filaments, emission etc. 4 popular bases and instructions for 1500 valve types. Large movement. Sturdy metal case.
$45.00
P&P $1.75

MULTI LIGHTMETER

Special "lux" scale used with extra probe 1000ohm/V.11 ranges, mirror scale. Ranges Vdc 10,50,250,1000; Vac 10,50,250,1000; Adc 1,100mA Ohms 150K Lux Probe. **$6.00**
90x60x30
$8.50 P&P 75c

SM7 SOUND LEVEL METER

Compact 6 range high sensitivity Ranges; 40 110dB: Taut band type movement: Scale-10to+10dB: Electret Mic Response 31.5—8000Hz 10.6Lx6.6Wx3.6H(cm) 150gm
$47.50
P&P $1.75

Mini Z Thermometer

Low cost Themister Instruments. Inc. Case, Probe, Lead etc. Remote operation to 30M. Model C +32 to +42°C ± 0.1°C (body temp. range) Model 2N −10 to +80°C ±1.5°C.
145x95x35
Mini ZC $29.50
Mini Z2N$29.75(P & P $1.50)

TEW PANELMETERS

MRA45B (49mm H x 52mm W)

0-1mA	$6.50
0-50uA	$6.90
0-5A d.c.	$6.90
0-20V d.c.	$6.90
VU	$6.90

MRA65B (82mm H x 100mm W)

0-1mA	$7.20
0-100uA	$7.90

Huge Savings on Special D.S.E. "EICO" Transformers

Manufactured for Dick Smith Electronics. Full satisfaction guaranteed.

DSE 2851	240V AC at 12.6V at .15A centre tapped	$3.50
DSE 2155	240V AC to 6.3 7.5, 8.5, 9.5, 12.6, 15V at 1 amp an ideal multi purpose power transformer.	$4.75
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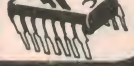

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INTERFACING A BURROUGHS SELF-SCAN DISPLAY PANEL TO YOUR EDUC-8

A Burroughs Self-Scan display panel is very suitable for use with the EDUC-8 computer system, offering full alphanumeric readout with large, brightly lit characters. The interfacing needed to hook up such a panel to your machine is quite straightforward, as explained below.

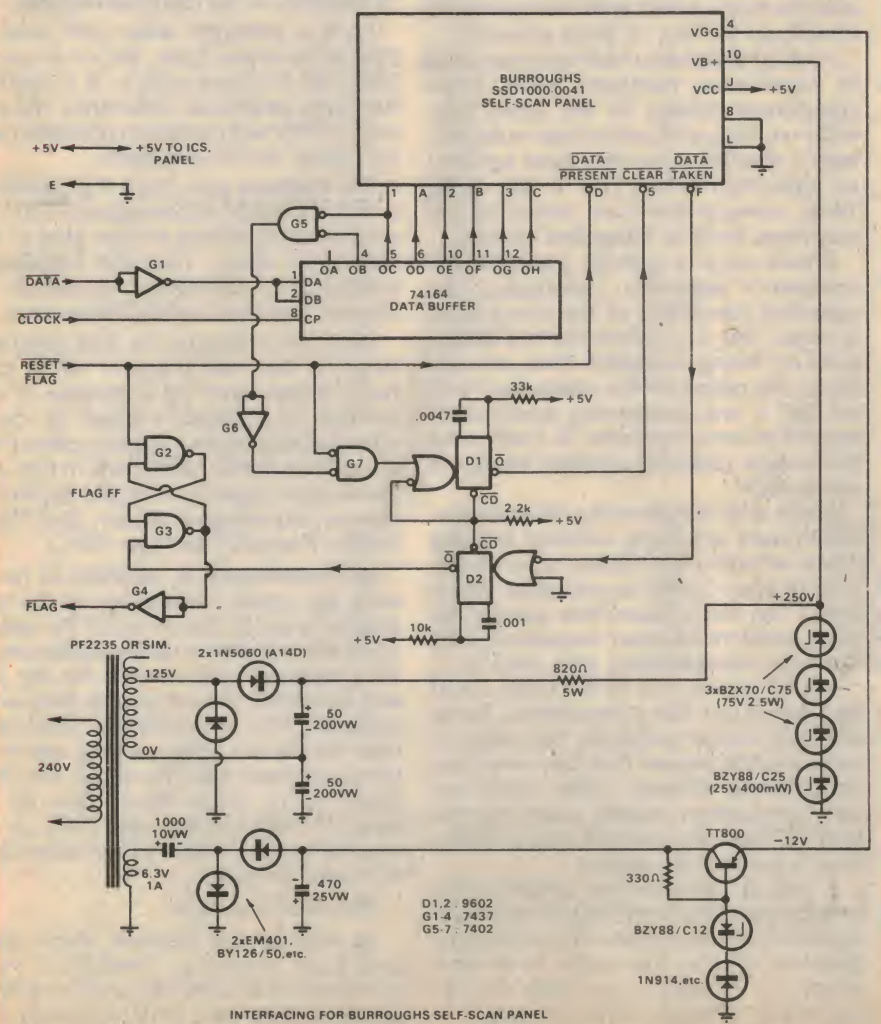
There are a number of display panels in the Burroughs range which could be used with the EDUC-8 system. I elected to try the SSD1000-0041, which has an internal refresh memory and can display a line of 16 characters 10mm high. Alternatively you could use the SSD1000-0040, which can display a line of 32 characters about 5mm high. There is also a panel which will display up to 80 characters 5mm high. All panels are available from Cema Distributors Pty Ltd, of 21 Chandos St, Crows Nest NSW 2065.

The SSD1000-0041 costs $204, plus $2 for a matching 10-way PC connector (SR-127), and plus 15% sales tax where applicable. This seems quite reasonable considering that it offers inbuilt refresh memory. Cema are providing data sheets with each unit purchased.

For details on the operation of Self-Scan discharge panels, I can only refer you here to Greg Swain's article in the October 1974 issue of Electronics Australia.

The interfacing required for the 16-character panel is shown below, and as you can see it is quite straightforward. A 74164 device is used as a data buffer, to provide the panel with its required 6-bit ASCII characters. The RESET FLAG(L) pulse is used to enable the panel's DATA PRESENT (L) input, while the panel's subsequent DATA TAKEN (L) output is used to set the flag FF via monostable D2—used to stretch the pulse to ensure overlapping the input pulse. Gates G5, G6 and G7 and monostable D1 are used to clear the display whenever a carriage return or similar non-printing control character is received, to begin a new line.

The Self-Scan panel requires two additional supply voltage apart from the +5V from the computer: +250V for the actual display, and -12V for the MOS refresh memory. These are provided by the simple power supply shown. Note that zeners are used to regulate the 250V line, which must be maintained within plus/minus 5%.



INTERFACING FOR BURROUGHS SELF-SCAN PANEL

EMI Colour service course

While there has been a lot of talk about the shortage of colour TV servicemen, little has been said on the positive side; about the Tech courses, the private courses by dealer organisations, or those by the manufacturers. Or, for that matter, about the individual servicemen who have studied hard to ensure that they really can give their customers good service.

In the October, 1974 issue I described the EMI colour receiver which, at the time of writing, had just gone into production. The story was based on a visit to the EMI factory at Homebush, NSW, a demonstration of early production models, and technical literature supplied by the company.

More recently I paid another visit to the factory in a somewhat different role. The company was conducting a colour TV service school and I was one of those privileged to attend.

While not the first course which this or other companies have conducted since colour TV was first announced, this one was notable for several reasons. One was that it was the most comprehensive course whch this company has conducted so far. Each course was spread over two days and two such sessions were being conducted weekly (Mondays and Tuesdays, Thursdays and Fridays). At the time I attended, appointments were being made six to eight weeks ahead.

Another important aspect of the course was it's timing. While it would have been possible to hold it at the time the sets were launched onto the market, this would not have provided any significant data regarding their behaviour in the field. By waiting several months, until many thousands had been distributed, the company was in a much better position to advise their dealers and servicemen on the practical problems which had been encountered

Short of producing a perfect receiver, the best thing that any manufacturer can do is to ensure that he has adequate feedback from his customers and dealers. Then he has to record the faults, analse them for possible patterns and as soon as one appears, seek the cause.

While this is normal procedure, it was interesting to see it in action, and to see the results which it had achieved. During the two days of the course we were presented with lectures by the technical staff, including Mr D Wallace, technical sales manager, and Mr L Downey, national service adviser. They described the significant faults which had been encountered so far, the symptoms they produced, their cause, and the recommended modifications aimed at overcoming them.

At the same time the visiting servicemen were encouraged to describe any particular problems they had encountered, whether they had solved them and, if so how. This also provided valuable feedback, both for the company and directly to the rest of those present.

Most of the faults which have occurred in significant numbers have been component failures in the sense that, while working well within their manufacturer's specifications, they have suffered an abnormal failure rate in the field. These components have varied all the way from fuses to integrated circuits.

Where such a pattern emerged the company's engineers investigated the operating conditions of the component in order, first, to confirm that the ratings were not being exceeded. Then, according to the nature of the component and the job it was performing appropriate modifications were made. In most cases this meant choosing another brand of component.

In this way components with excessive failure rates are being weeded out and replaced with more reliable types. In the case of one IC with an excessive failure rate it has been found that exactly the same problem has been experienced by overseas manufacturers who used it.

But, to be fair, not all the faults could be blamed on the components. Some involved design problems but were of such a subtle nature that they were not immediately obvious. Only when the early production models went into the field did these become obvious, and then only in isolated situations.

A typical example was a faint white vertical line a few inches in from the right hand side of the screen. This is normally apparent only in low signal level situations, i.e., outlying areas where the signal level is adequate—but only just.

The cause was a small spike being generated in the horizontal deflection system and which radiated sufficient energy to compete with a weak signal. The cure was simple—a couple of ferrite beads slipped over the appropriate wires. All production models now carry this modification and modification notes have been issued to servicemen and dealers.

Another problem involved the IC socket fitted to the horizontal deflection board. This gave trouble in some early models due to excessive flux acquired during the flow soldering process. This was overcome by selecting a different type of socket and modifying the soldering process.

One problem discussed had nothing to do with any particular make of set. This is the effect the aerial installation can have on a colour set. The lecturers confirmed what most of us have already learned by practical observation; that an aerial which gives a good monochrome picture will also give a good colour picture.

But there is one exception. Any fault in the aerial system which causes standing waves to appear on the feeder can cause loss of colour. For this to happen the delay between the original signal and the reflected signal must be equal to one half cycle at the sub-carrier frequency (4.43MHz), or 0.11uS approximately.

Such a reflected wave will tend to cancel the colour burst, since it is exactly 180° out of phase with it. If it reduces the burst amplitude sufficiently the sets colour killer will come into operation and no colour will be presented.

The insidious part about this condition is that it is seldom immediately obvious on the monochrome picture, due to the very short delay. Thus the installation technician or serviceman is unlikely to suspect the aerial unless forewarned.

And, according to the EMI lecturers, this is a very real problem which they have encountered on a number of occasions. It is usually caused by crude attempts to provide multiple outlets from a common aerial, particularly in flats and home units. More specifically, by branch runs of unterminated feeder. (See "Electronics Australia" for June 1975.)

As I understand it, builders of home units are slowly waking up to the fact that it is a good idea to install TV outlets while the building is under construction. They normally call tenders for the job and, inevitably, the job goes to the lowest tenderer. This is usually the electrician who installs the power wiring and who knows virtually nothing about the finer points of TV signal distribution. So he runs TV feeder at the same time as he runs the power cable—and in essentially the same fashion.

The result is chaos.

As well as the lectures, there were practical sessions. Students were grouped in pairs and allocated a receiver an which they were able to perform the various setting-up procedures under in-

struction. For those who had not previously tackled these jobs, at least on EMI set, it was an excellent opportunity to acquire first hand knowledge. And even those who were obviously familiar with the chassis were still able to learn a fine point or two.

On the second day we were taken on a tour of the colour TV factory. I had seen it before but I must confess that a production line of this magnitude never fails to impress me. It brings home most forcibly the vast amount of organisation and planning which must go into an operation of this kind; an exercise which is quite distinct from producing the original design and the preproduction models in the first place.

For most of us the most interesting part of the tour was the test and adjustment procedures on various sections of the set as they came off the assembly line . We also had the opportunity to talk with the testing staff and discuss typical symptoms and problems.

Finally, we were able to watch the final test procedure, including a full covergance adjustment and, again, disguss the whole subject with those doing the job.

While still on the factory floor we were shown the repair section where faulty boards, returned from dealers and servicemen, are reconditioned. A number of complete sets are used as test jigs, into which the faulty board is plugged. From its behaviour, the fault is diagnosed and repaired. In addition, any modifications applicable to the board are carried out and the board given a prolonged soak test. It then goes into stock to be reissued as an exchange board.

In the event that no fault is apparent when plugged into the jig, it is assumed that the fault is intermittent and the board is left in the jig until the fault shows. In this regard the company is asking dealers to label any board which they suspect is intermittent. This would make repairs a good deal easier.

In some cases boards are returned in a damaged condition, usually charred by an overheated component. In such cases the board is scrapped, though it is worthwhile to salvage the larger and more expensive components from it.

As explained in the October article, a serviceman can deal with a faulty board in several ways. If the nature of the fault is immediately obvious he may elect to repair the board on the spot, thus giving the customer the cheapest and quickest repair.

If the fault is more obscure he may replace the board with one from stock, once again giving the customer an immediate repair and, possibly, one that is no dearer than if he had spent valuable time searching for the fault.

The faulty board may then be either returned to the company who will issue a replacement board, or the serviceman may elect to repair it himself. There are seven boards in all, and the exchange fee seems to me to be very reasonable. The recommended retail price, i.e. the customer's price, is $15.00 for each of six boards and $22.00 for the seventh. On these figures the serviceman makes a small profit, in addition to his normal service charge.

Yet, in spite of these attractive figures, a surprisingly large number of servicemen are electing to track down the fault and make the repair themselves. The reason they give is simply that this the best way to learn.

The final lecture of the course was given by Mr G. Green, senior TV design engineer. He discussed many of the design features of the set, some of the problems encountered during the design phase, and how these were overcome. He also discussed some of the early service problems and how they were tackled. Altogether, a very interesting couple of hours.

In addition to the more formal aspects of the course already described there was a distinct social side; the opportunity to meet other servicemen over morning coffee or at lunch and "talk shop". In it's own way this was just as valuable as the formal side.

At the session I attended most of the servicemen were from the country, some from the very borders of the state. The thing that struck me most about them was their enthusiasm and high morale. Scare stories about colour TV being "too hard" cut no ice with them. As far as they were concerned colour TV was here, it was something they had to learn, and they intended to do just that. As one of them put it, "All this paper talk about TV servicemen not being able to cope with colour is a lot of baloney." (Only he didn't say "baloney".)

There was a lighter side to our disscussions too. Since I am always on the lookout for a little humour to lighten the tone of these pages I deliberately raised the subject of strange beliefs by non-technical customers.

This brought forth a number of reminiscences, particularly from the country boys, about some of the eccentric characters among their customers. Unfortunately most of them, humourous though they were, were not directly concerned with radio or TV and so are hardly appropriate to these notes.

But there were two that I felt were worthwhile passing on.The first one involves a simple error in terminology; a lady customer who insists on refering to the antenna as the "lantana".

But the second one takes first prize in my book. It concerns a dear old lady who lives several miles out from a country town. According to the chap telling the story she rang him one day and asked him if he would bring out a new battery for her radio the next time he was out her way, adding that she thought it must be getting weak.

The diffidence of the last part of her remark made him suspicious. Why did she think the battery needed replacing? Was the set functioning at all? If so was it distorting? Or weak?

"Oh no", she replied, "nothing like that. The set is playing very well. It's just that last night's news was 10 minutes late."

After the laughter had died down several of us, including myself, accused him of pulling our leg. He was most indignant. Raising his right hand he looked around for an appropriate book on which to place his left hand.

"I swear it's true", he insisted, "and if someone can produce a Bible I'll swear it on that too."

Unfortunately, Bibles are rather scarce in such situations. I thought of substituting one of the text books or service manuals lying around, but somehow they didn't seem to completely appropriate. I suppose I'll just have to take his word for it .

And that is probably as good a note as any on which to finish, except to say that I think this company is to be congradulated on organising such valuable instruction at such an appropriate time. Other companies could well take note.

Circuit & Design Ideas

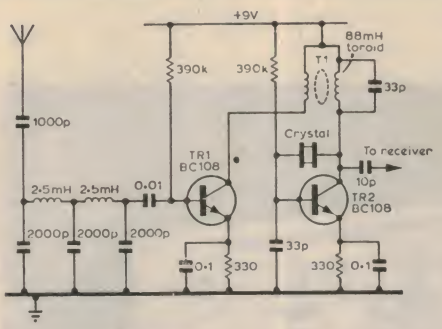
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Very low frequency converter

Lionel Sear, G3PPT, has an interest in VLF reception and has investigated the use of a number of simple receivers for this purpose. He finds thay by far the simplest and best solution is this very simple converter.

The incoming signals pass through a simple low-pass filter which cuts off in the low hundreds of kHz and they are then amplified by TR1. The transformer T1 is essentially an 88mH toroid and this acts as a wide-range "modulation" transformer so that the signals from TR1 modulate the Pierce crystal oscillator. This means that the VLF spectrum now



appears as two sidebands stretching out on either side of the crystal frequency. How low it can be tuned depends on how close one can tune to the crystal frequency on the main receiver. Further away from the crystal frequency stations around 200kHz come in strongly. The crystal used is on 3720kHz but almost any HF crystal could be used.

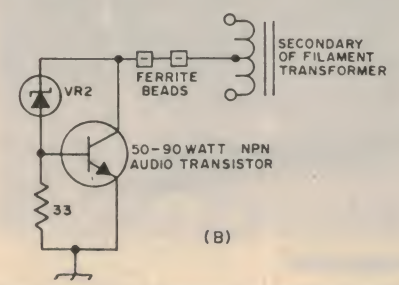
G3PPT has found that television time-base interference can be rather fierce at the low frequencies. On the other hand, he has had no problems for IF break-through of signals around 3.7MHz.

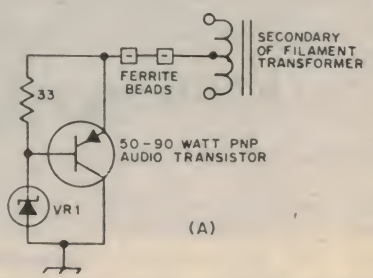
(From "Radio Communication".)

Alternative to high wattage zener diodes

High-wattage zener diodes, the type used to develop bias in some linear amplifiers, are often hard to find. While they are not terribly expensive, not many distributors stock zener diodes of the 50-watt variety. The accompanying diagram shows how a 1-watt zener diode, an inexpensive 50- to 90-watt audio transistor along with a half-watt resistor, can be connectd to perform the same function. Circuit A uses a silicon or germanium pnp transistor. The voltage rating of the zener diode should be approximately 0.3V less than the desired bias voltage for a germanium transistor and approximately 0.7V for a silicon unit.

The circuit at B uses an npn transistor.





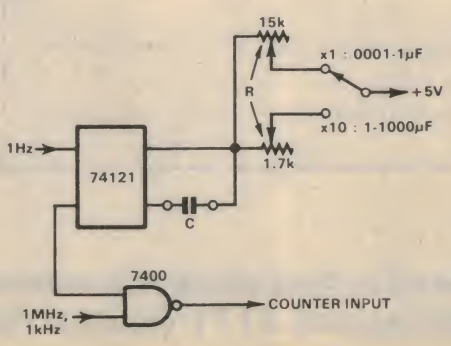
Again either a germanium or silicon transistor may be used, and the zener diode voltage rating is the same as that for circuit A. The transistor should be bolted to the chassis, using the chassis as a heat sink. In circuit A the transistor can be bolted directly to the chassis, but the circuit at B will require a mica insulating washer because the collector (case) is above ground.

For bias generation work, ferrite beads should be placed on the transformer centre-tap lead to discourage parasitic oscillations. (From "QST")

Capacitance measuring adaptor for digital counter

Readers who have built the 20MHz Digital Counter may be interested in the details of a direct reading capacitor checking adaptor which uses the counter to read capacitance in uF directly. The usable range is from 500pF to 1000uF. The logic is as shown.

The adapter is supplied with power and 1Hz pulses via a 5-pin DIN plug. The 1MHz/1kHz comes from the Calibrate socket. The 1Hz drives the 74121 in step with the internal counter logic and 1MHz/1kHz pulses enter the counter for the duration of the pulse from the 74121, which is proportional to RC. R can have



two values (15k and 1.7k) which produce pulse widths in the ratio 10:1. The decimal point is also suppressed when the DIN plug is inserted. In addition a small modification to the counter logic enables the leading zeros to be unblanked for the 0001 to 1uF range (impractical if the overrange LED is installed).

A DPDT switch is required on the counter to bypass the amplifier. If this is not done, it tends to block momentarily when hit with a slug of 1MHz pulses at TTL level, and so reads low.

(By Mr W. A. Jolly, 29 Hay Street, Walkerville, SA 5081.)

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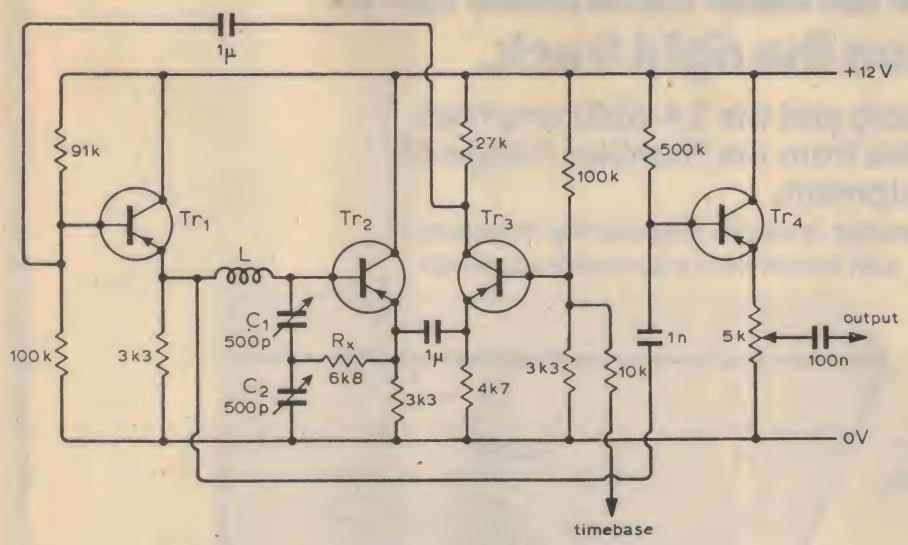
Wobbulator



This circuit is derived from a voltage-controlled oscillator mentioned by F. Butler in the December 1965 Wireless World, in which the effective inductance of the coil is controlled by the amount of feedback.

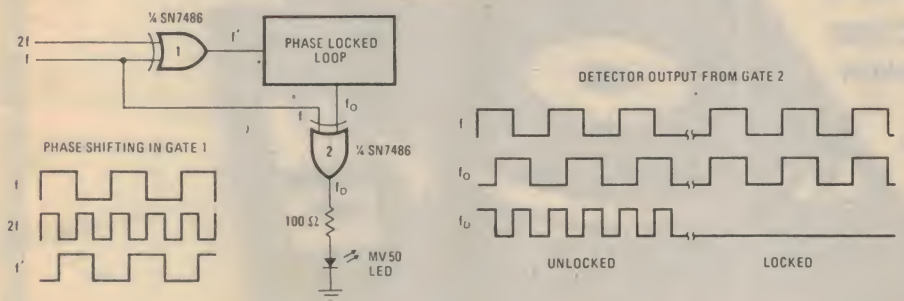
The circuit shows how this has been modified to produce a wobbulator circuit which is cheap and simple to set up. Feedback is now taken, without phase change, via Tr3. This transistor can vary the feedback in accordance with a voltage control at its base. If this is derived from the ramp output of the oscilloscope timebase the frequency of the oscillator will follow the variations in the timebase sweep voltage.

The centre frequency of the sweep may be varied readily by adjustment of C1 and C2. The circuit as described is used at 450 to 500kHz, but there seems no reason why, with a change of coil, it should not operate at 1.6 or 10.7MHz. Versions using BC107s, BF115s and BF194s have been made. Resistor Rx may need to be varied to give the best waveform with different transistors and probably for use on different frequency bands.

When the ramp voltage, which can be derived from the timebase, cannot be used directly at low impedance it is suggested that an emitter follower should be used and a suitable proportion of the output tapped off the emitter resistor.

(By E. C. Lay, in "Wireless World.")

Logic gates and LED indicate phase lock



Phase-locked loops are widely used for signal processing and digital applications such as FM demodulation, tone-decoding and clock synchronisation. If the error signal is accessible, signal acquisition and locking in the PLL can be observed from decrease of error voltage to zero. For integrated-circuit PLLs without an error signal terminal however, acquisition and lock can be indicated by two exclusive-OR gates and a light-emitting diode. The LED glows brightly when the input signal is first applied, then dims as the loop signal pulls into synchronism and it goes out when the loop locks.

If the locked signal from the loop were in phase with the input to the loop, a single-OR gate would suffice for the indicator. In fact, however, the locked signal lags the input by 90°, so a second gate is needed to introduce a quadrature shift either on the input or output signal. As shown in the figure, the phase is shifted by applying frequencies f and 2f to an exclusive-OR gate. In the circuit shown here, the extra 90° is added to the locking signal before it goes into the loop; this procedure is convenient when f is generated by counting down from a master oscillator, because 2f is readily available.

From the square waves at f and 2f, gate 1 develops a 90°-shifted signal f' that is the input to the loop-phase detector. Gate 2 functions as an auxiliary phase detector, comparing the phase between the loop output fo, and the non-phase-shifted input f. The output from gate 2 fD, drives the light-emitting diode that indicates acquisition and lock.

When the loop is locked and its natural frequency is close to f, the inputs to the detector coincide. The resulting pulse width of the signal present at its output is either tiny or nonexistent, so the LED is turned off. When the loop is out of lock and its natural frequency is far from f, maximum output pulse width is obtained and the LED is turned on at its maximum brightness. As the loop acquires lock, the output-pulse width decreases, decreasing the brightness of the LED.

(By R. P. Leck, in "Electronics".)

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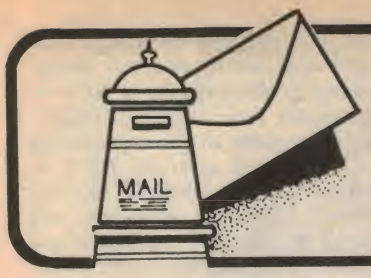

Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Record reviews

I preface the comments below by describing my musical tastes as "middle-of-the-road", with a leaning to guitar instrumentals, etc.

May I ask why does the classical records section of the magazine devote two to four times the space per record review compared with the "Variety Fare" reviews? Is this snobbishness? Is the classical music reviewer more knowledgeable about what he is writing? I suspect so, but if this is the case, perhaps "experts" in the respective music fields covered in Variety Fare should be approached.

There is no justifiable reason why approximately equal space could not be given to each and every record, whether good or bad.

Your current approach seems to be the result of a "classical vs others" attitude, which I believe you have shown for some time.

I would be interested if you can justify the meagre reviews that "modern" recordings are given.

M. K. MacDonald, Unley, S.A.

COMMENT: In the reviews of middle-of-the-road records we try to convey the essential information which we think buyers of these records require: Title information, contents and performance, the audience to which it will or will not appeal, technical quality, aspects of particular note. Traditionally, classical music enthusiasts have been considered to be more involved with the background to the music, performers and performance, as evidenced by reviews and jacket notes alike. We will plead guilty to tradition, but innocent to conscious snobbery.

On the other hand . . .

May I express my gratitude for Julian Russell's excellent appraisals of cassettes. Not only for the musical reviews on these, but also and perhaps more particularly for the comments on cassette quality, when at the moment high quality pre-recorded works are scarce.

These excellent reviews are very reminiscent of those by the late John Moyle, in "Radio and Hobbies". A great percentage of my mono record collection was selected from these reviews, and they still give a very good account of themselves, even by today's standards. I venture to say that cassettes selected from J.R.'s current reviews will be equally satisfying in years to come.

May I suggest, though, that you give the approximate playing time per side as a regular feature, as this can be helpful in selecting the version giving the longest uninterrupted listening of sections in major works.

To Julian Russell, then, please continue with the good work, and to the Editor, please continue publishing reviews of this nature.

Keith L. Green, Hawthorndene, S.A.

COMMENT: By sheer coincidence, your letter came in hard on the heels of Mr. Macdonald's. The two together certainly show the diversity of interest and outlook in the area concerned! Your suggestion regarding playing time seems a good one, and we shall see if this can be done.

Brake pulser

As a regular reader of your magazine I am appalled that the article by Mr A. Beekman has appeared in the June issue.

With the road toll rising every year and the costs being passed on to the whole population of Australia in the form of families deprived of loved ones, to print an article which seems designed to cause more mayhem than ever on our roads seems to me to show a very poor spirit of co-operation indeed.

As you and every other road user must have noticed there are a large number of vehicles travelling on the roads with defective lights. Quite often only one brake light is working. Normally this is not a really serious matter unless the other light fails when there is no brake light at all.

Any cars fitted with this monstrous pulser designed by Mr Beekman are of course in an entirely different category altogether. Visualise a vehicle with a left hand brake light inoperative, the driver is about to turn left and applies his brakes to slow down, and the right hand brake light flashes a turn right signal. The following driver quite correctly moves left to pass on the left hand side. Do I need to go into details of what happens next?

Fortunately I understand that flashing brake lights are illegal in most states for this very reason.

For Mr Beekman's benefit may I suggest that if it is too much bother to pay attention to your driving, don't drive.

R. Woods Riverdale, W.A.

Mr Beekman replies:

May I just make a couple of points in reply to Mr R. Woods' letter condemning the use of a brake light pulser.

1. Trafficator light lenses should by law be amber in colour, and not red.
2. Pulsing rate of this unit is 0.1 sec. on and about the same time for off. Only between 3 and 4 flashes are given, and after that the brake lights stay on as long as the brakes are applied. The pulsing rate of trafficators is much slower, around 100 flashes per minute, and is continuous.
3. This unit obviates the need to attract the attention of a following motorist by manually "pumping" the brake to make the lights flash.
4. Where brakelights are combined behind the same lens with the tail light (as for example in the case of the latest Holden) while driving at night, you only have to blink once and you are not aware at all that the car in front has applied its brakes.
5. Turn signals should be given at least 30 metres before turning.
6. Assuming Mr Woods is sincere in his concern for road safety, I am puzzled by his implication that the non working of any lights is "not a really serious matter".

A. Beekman Enfield, NSW.

Classical Recordings

Reviewed by Julian Russell

Complete opera: Tristan and Isolda

WAGNER—Tristan and Isolda. Complete opera. Kirsten Flagstad (Isolda); Blanche Thebom (Brangane); Ludwig Suthaus (Tristan); Josef Greindl (King Mark); Dietrich Fisher-Dieskau (Kurvenal) and others with the Philharmonia Orchestra and the Chorus of the Royal Opera House, Covent Garden, conducted by Wilhelm Furtwangler. World Record Club Stereo S/5363-4-5-6-7. (Five discs in Box with English/German libretto.

For many years the Furtwangler/Flagstad Tristan has only been a legend to me. For a recorded version I have relied on, and enjoyed, the Solti/Nilsson set. So it was with considerable excitement that I put the first disc of the Furtwangler on to my turntable. I started with Act 2, by the way, and was immediately enchanted. The Solti set is good but here was a sensuous quality in the playing and singing unique in my experience of the work. Beside Nilsson's sturdy Isolda with its many merits, Flagstad sounded the very essence of femininity. Although her top register was showing slight signs of wear—we all know about Schwartzkopf standing at her side to take the two top Cs for her—it was still voluptuous throughout the rest of her range.

And Furtwangler won sounds of similar voluptuousness from his orchestra. The balance between voices and orchestra was always stable and, if the conductor's tempos were sometimes a shade on the slow side here and there, he had an infallible knowledge of when to quicken them to produce an effect of incandescent passion. Flagstad was lucky too in Ludwig Suthaus' Tristan, which had a hint of baritone quality sometimes that magnified its masculinity and spared us from the Bayreuth "bark". I could find only one detail to criticise. Flagstad's low register was so warm and steady that a close knowledge of the score was necessary to distinguish it from the excellent Brangane of Blanche Thebom. Otherwise I bathed luxuriantly in this marvellously erotic act, a hashish dream of love if ever there was one.

Later when I started the work from the beginning I was sometimes—but only rarely—disturbed by the balance which occasionally favoured the singers at the expense of the wonderful orchestral part. One other point, albeit a minor one: The trumpet fanfares that signal the arrival of King Mark at the end of the act are supposed to be heard backstage and indeed the last chord continues to be heard in the theatre for a moment after the curtain has fallen, which gives a marvellous effect of continuing action. In Furtwangler's performance they sound as if they were played in the orchestra pit.

I consider Tristan to be Wagner's supreme achievement because nowhere, except in Mark's narration towards the end of Act 2, is one conscious of the labour that went into its miraculous organisation. The sheer inflammability of its inspiration gives the whole work an air of constant spontaneity.

There is much to marvel at the organisation in The Ring, the Mastersingers and Parsifal but, in these, one is sometimes aware of the enormous intellectual effort that went into their creation. Tristan is different. It never flags, except perhaps for the brief episode mentioned above, and even that is dramatically a point of repose between two mighty climaxes. The music flows with all the uncluttered fluency of eloquent speech. But it is never, except during Tristan's last act hallucinations, hysterical. And it is the realisation of all this that, I think, is the key to Furtwangler's inspired interpretation of this masterpiece, his recognition that it is one of the greatest achievements of the human mind in any medium. Where Solti fails to emphasise the dramatic change in the harmonies of the horns' hunting theme when Mark returns towards the end of Act 2, Furtwangler makes it a movement fraught with peril for the guilty lovers. And this is only one example among many too numerous to mention individually here.

By the way, unless you have a very good knowledge of the score, you might easily be misled by the accompanying German/English libretto that places the different sides in the wrong spots. And an added difficulty will be encountered, as I mentioned above, by the similarity of timbre between the two women's voices when Flagstad uses her thrilling low notes. I have noticed some moments of disappointment—moments only—in an occasional bar. Perhaps I was expecting too much from a performance of the opera recorded as long as 22 years ago. But when one considers the economy price of this set to members of the World Record Club, with its many thrills to excite even the most jaded palates, it is a rare bargain in these days. And if I have failed to mention Fischer-Dieskau's superb Kurvenal and Josef Greindl's King Mark—well, one must stop somewhere.

Moussorgsky—Khovantchina: "only available recording"

MOUSSORGSKY—Khovantchina. Complete opera. Nicholas Tzyeych (Prince Ivan Khovansky); Alexander Marinkovich (Prince Andrei Khovansky); Drago Startz (Prince Vasili Golitsin); Dusn Popovich (Shakloviti); Miro Changalovich (Dosifei); Melanie Bugarinovich (Martha); Sofia Jankovich (Emma); and others with the Chorus and Orchestra of the National Opera, Belgrade, conducted by Kreshimir Baranovich. World Record Club Stereo R10787-8-9 (S/5658-59-60).

I would not normally have thought this mostly indifferent performance and recording worthy of mention in this column except for one fact—it is the only available recorded performance of a great opera. Khovantchina has had a curious history. Moussorgsky left it largely unfinished with no orchestral score. He did, however, leave it complete in "short score" form and that industrious meddler in other people's music, Rimsky-Korsakov, did the necessary work to prepare it for a stage performance. And unpardonably he made alterations to the composer's original music. In an effort to correct this, an unusual combination of musicians, Ravel and Stravinsky, late in the 1920s got permission from the Soviet Government to visit the archives in Moscow and see what could be done to restore the work to conform more to the composer's intentions. Nothing came of this, however, and, since then, Shostakovitch has reorchestrated and generally cleared up Rimski's impertinences. I have not heard this version which, to my knowledge, has, alas, never been recorded.

The plot, of considerable political intricacy, is not easy to follow, but it boils down to the conflict between the old-time religious conservatives, many of them nobles, against Peter the Great's efforts at reform. As in his Boris Godounov, Moussorgsky again uses the chorus, not as a decorative background to the action, but as a living personality

of the cast. And this chorus is one of the best elements in the set. Some of the voices are fair, especially among the men, and occasionally even good, but the women are awful with their wide Slavic tremolos and hard vocal production. Even the best of the men, too, sometimes have this irritating wobble.

The quality of the engineering is, to put it mildly, far from refined, and the orchestra plays efficiently though without any lustre on its tone. Best to come off is the Fourth Act with its mixture of drama, dancing—the Persian ballet can still be listened to with delight time after time—and sudden murder. Elsewhere things are not so satisfactory except for some glorious highlights. But since the chance of hearing a good performance of a well-reconditioned score here in Australia is very remote indeed, I recommend this version in the absence of any other.

For information on World Record Club albums, contact the Club at 605 Camberwell Rd., Hartwell, Vic., 3124. Tel. 29 3636.

LISZT—Hungarian Rhapsodies Nos. 1 to 19. Michele Campanella (piano). Three discs in box. Philips stereo 6747 108.

I have long ceased to wonder at the perfection of technique of the younger generation of pianists and violinists. So I was not surprised when I listened to the extraordinarily high standard of achievement of Michele Campanella, a young Italian not yet 30. This is the first of his records I have heard and the similarity of style among the Rhapsodies gives no idea of the breadth of his culture. But in these works he is really great. His articulation is always assured in even the fastest of passages delivered without any hint of recklessness. No note ever trips over its follower. His range of sonorities is wide enough to give constant colour to whatever he is playng. I wondered if this is the way the great Liszt himself might have played these pieces. But Liszt, although a supreme musician in the creative field, was also a great showman. He had a following of swooning women enraptured by his playing that would have made a modern pop star envious, although they were of an older generation than the screaming teenagers who nowadays hypnotise themselves into hysterics when their favourites perform. But the fact that they were, generally speaking, older than their modern counterparts did not prevent some from picking up his cigar butts and putting them down the bosom of their dresses. Companella's style is much more modest. He achieves a true rhapsodical quality without ever losing the strictest control over his playing. Yet it is never "sicklied o'er with the pale cast of thought". Even the most difficult passages sound wonderfully spontaneous.

All these rhapsodies have a strong family likeness to each other yet closer examination reveals subtle differences, sometimes slight, often very significant indeed. Campanella captures their romantic spirit quite without any slipshod thinking. He can caress a phrase firmly, yet with the utmost delicacy. And the recorded piano tone is as faithful as any I have ever heard. Although his playing can be described as consistantly brilliant, it is always refined. He is all that Cziffra might have become. Sometimes he glitters, sometimes he woos. Always he sounds exactly right in his treatment of the material provided by the composer. Virtuosity without slickness is perhaps the best way of summing it up. I think he is destined for greatness but, before being sure, I would like to hear him in music that demands from him something weightier emotionally. In addition to all these great merits he has an exciting sense of rhythm that carries one irresistably with him.

Fine as every one of these rhapsodies is, I do not recommend playing the whole recital through at one sitting. But you may find it interesting to compare one of the earlier fifteen with later 16th to 19th and note the differences in the composer's more mature style. Campanella seems equally at home in both styles. The later rhapsodies you will find on the second side of the third disc. But this is not to say that surprising things don't happen harmonically in even the earliest of the set. But the last ones are on very foreign ground compared to such early exercises as the popular, even hackneyed No. 2. These last have an extraordinary freedom of form and content. At first hearing they sound a bit cursory, explorative, yet on aquaintance each has its own hard logic without any striving for prettiness. All 19 make the same enormous technical demands on the performer and Campanella never falters in their realisation. Here is a set I can enthusiastically recommend to high—and middle-brow—buyers. They should provide endless enjoyment.

Goodman transcriptions

TRANSCRIPTIONS WITHOUT APOLOGIES. Pianist Isadore Goodman recorded in the Sydney Opera House late last year. EMI Stereo 0ASD7585.

Isadore Goodman is so seldom heard nowadays that it is timely for this galant recital to remind us of just how good a pianist he is. Most of his time is taken up teaching at the NSW Conservatorium and for that reason visible to only a few. The merciless portrait on the record sleeve puts him into the Artur Rubenstein age group which is far from the truth. His style is very different from Campanella's reviewed above. Goodman has a softer, more romantic touch exquisitely modulated in dynamic graduations and still beautifully fluent in fast passages. Despite what I said about his photo he still looks as elegant as ever and his playing reflects his appearance.

His title is an apt one. There is nothing disreputable about transcriptions from one instrument to another. It was made respectable by J. S. Bach and has since had a long line of distinuished practitioners. All those chosen by Goodman are in excellent taste and some of them seldom heard. Who indeed suspected Dohnanyi of having transcribed Delibes' delicious Naila waltzes? Under Goodman's fingers they sound altogether enchanting. Anyway let's begin at the beginning.

Goodman starts with the fairly well-known Godowsky version of Albeniz' Tango. I liked this rather less than some of the others. It seems to miss by a trifle a true Tango swing and, though his touch is aways beguiling, Goodman seems to pay too much attention to subordinate notes, which gives the piece a slightly straight-laced air.

Wagner's Magic Fire Music from the Valkyrie is played very clearly and deliberately. It is quite a virtuoso effort but not very grateful for those who know the music in its original orchestral version. The transcription is by Lois Brassin, a now forgotten French piano teacher and minor composer born in 1840. Two German lieder come off very successfully in their new dress by Franz Liszt. Not surprisingly, I might add, for Liszt was one of the very greatest of all transcribers, and I am not forgetting Busoni.

The fourth item, a Pastorale and Capricco by Domenico Scarlatti arranged by Tausig, is a delight in style and technique. Every note seems to lie naturally under Goodman's fingers. I have only one churlish comment to make—it seems to go on a trifle too long.

To complete that side of the disc there is the Naila piece mentioned above. This is a splendid transcription with—I thought I detected—tiny but effective changes of harmony here and there.

Side 2 opens with another Schuman lieder, Spring Night, again transcribed by Liszt, and goes on to Ravel's own piano version of his orchestral piece, Alborado del Gracioso. It starts in a very sprightly, dandyish manner and goes on effectively to the stuttering serenade. Goodman then plays the Bach/Busoni Rejoice, Beloved Christians with impressive fluency and accuracy and splendid balancing of the right hand against the left. Like Ravel, Falla himself transcribed his Ritual Fire Dance for piano and for a time Rubinstein used to play it almost as a signature piece. Here Goodman plays it with fine verve.

The final item is the great Rigoletto paraphrase by Liszt, perhaps the most popular of the many really great paraphrases in the Liszt piano literature. It makes a triumphant finale to this recital all of which shows so young a spirit as to make the sleeve photograph appear all the more brutal. If there is a rare bar of unevenness, perhaps momentary loss of concentration, well there are ample compensations.

Lighter Side

Reviews of other recordings

Devotional Records

SAVED. Pat Boone. Stereo, Lamb & Lion LL-1013. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

Pat Boone's devotional releases on his own Lamb & Lion label continue to multiply, each one characterised by pleasing, smooth sound, carefully planned midway between the modern idiom and the more traditional approach. As such, this one, like all the rest, is well suited to family listening.

With a restrained C&W flavour, the titles are: Radio Station S-A-V-E-D—God's Little People—I Feel Like Travelling On—Where Will I Shelter My Sheep—Over The Next Hill We'll Be Home—What A Song—Billy & Rex & Oral & Bob—Mighty Closer To Heaven—I See A Bridge—I'll Meet You In Church, Sunday Morning—Way Down Deep In My Soul—The Great Judgment Morning.

The sound is slightly lacking in the ultimate treble but it is full and smooth and must be judged as very pleasant listening. The jacket note is devoted principally to a sincere tribute from Johnny Cash to the positive influence of Pat Boone on his own christian committment. (W.N.W.)

★ ★ ★

THE WORD BECOMES MUSIC—FAMILY. Stereo, M7 label MLF-078.

Recorded at the Trafalgar Studios in Sydney, this M7 album features Ian Truscott, Phil Truscott and Ian Smallbone. Based directly on Biblical texts and themes, it translates the traditional Gospel message into modern sound idiom without, however, stepping outside the likely tolerance of the older members of audiences and congregations.

I wasn't all that impressed by the first track "Standing At The Door" but the very next "Born Again" is a clever treatment of the central theme. Other tracks are: Living Water—A New Commandment—Beautiful Feet Blues—The One To Turn To—The Lord Be With You—If We Abide—Philippians 4, 8—Psalm 51.

The sound and surface is very clean and the overall balance is good. An album that I think would particularly interest budding young church musicians who are seeking a sound and a format. (W.N.W.)

★ ★ ★

MAKE A JOYFUL NOISE. The Fountain Street Church Choir directed by Mr. Beverly R. Howerton. Allen Computer Organ played by Donald L, Westfield. Stereo (no brand), DLW-1015.

In many years of reviewing, this is the first time I can remember having to type "no brand". The reason, probably, is that the album relates to an historic local occasion, recorded primarily for the local congregation—and the Allen Organ Company. But what an occasion!

The venue was Saint Francis de Sales Roman Catholic Church in Muskegon, Michigan. A relatively new and contemporary structure of solid poured concrete, it is of massive proportions, with a reverberation time smoothly graded out to no less than 7 seconds!

In this building the church authorities have recently installed an Allen computer organ and this was the inaugural performance, recorded on November 15, last. The organ is heard mainly in a supporting role to the choir but adjectives like delicate, sensitive, spacious, massive all suggest themselves in turn. And the instrument lives fully up to expectations in the one solo track on side 2.

The choir, in fact, is from the Fountain Street Church, with its roots in a one-time Baptist mission but now of a stature that has justified an international tour, taking in England's great cathedrals. This, then, was the "local" occasion.

And here are the track titles: Make A Joyful Noise (Williams)—Twenty-Third Psalm (Matthews)—Christmas Day (Holst)—Lacrymosa, Requiem (Mozart)—Jubilate Deo (Bales)—Grant Me True Courage Lord; Sinfonia From Cantata 129 (Bach)—Winter Comes (Kimmel)—Now Sleeps The Crimson Petal (Quilter)—Give Me Your Tired, Your Poor (Berlin)—The Lord Bless You And Keep You (Lutkin).

This is a good record on any count but especially relevant it you want to gain an appreciation of how this modern electronic organ can perform in an acoustic environment where one would normally find a big pipe instrument. As a member of my household is given to remarking: "I like it, I like it!"

Perhaps not surprisingly, the review copy came to me via Allen Organs (Aust). You can obtain a copy for $6.00 post paid from the above company at either of two addresses: 32 Woodhouse Rd, Doncaster East, Vic 3109; or 39 Roland Av, Wahroonga 2076. Recommended (W.N.W.)

Instrumental, Vocal and Humour.....

THE MYTHS AND LEGENDS OF KING ARTHUR AND THE KNIGHTS OF THE ROUND TABLE. Rick Wakeman. A & M L 35496.

Rick Wakeman's latest album is similar in concept to his earlier Journey To The Centre Of The Earth. The story of King Arthur and his Court is told in musical form, aided by a lavishly illustrated booklet.

The words of the songs are printed in the booklet, so it is possible to follow the story through the album.

Other artists featured include the English Chamber Choir (of "Tommy" fame), and the Nottingham Festival Vocal Group, as well as a forty-seven piece orchestra and a six piece band. Fortunately, Rick has managed to keep this large ensemble under firm control, and the result is a pleasant musical experience.

My personal favourite amongst the tracks is Sir Lancelot and the Black Knight, with Merlin the Magician ranking a close second. Other tracks included are Arthur—Lady of the Lake—Guinevere—Sir Galahad—The Last Battle.

The quality of the recording is excellent, although my copy was slightly warped. Fortunately, this did not seem to have any detectable effect. (D.W.E.)

★ ★ ★

SONGS OF LOVE AND OTHER THINGS. Aimable. Vogue stereo L-45511. 2-record set $7.95.

It is not at all clear from the cover of this 2-disc album just what is the name of the French orchestra featured but I gather it is just called "Aimable". At any rate it is a fairly large orchestra which features piano accordion and Hammond organ.

A fine collection of tunes, some new and some very old, has been collected for this album. I found it most enjoyable, particularly as I had not heard some of the tunes for many years and it was like meeting old friends. Record quality was good and stereo spread was wide and even. Definitely, a good buy.

Space does not permit a list of the 33 tracks but here are just a few: I Can't Give

Reviews in this section are by Neville Williams (W.N.W.). Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.) and David Edwards (D.W.E.).

You Anything But Love—My Louise—The Whistler And His Dog—Lichensteiner Polka—La Vie En Rose—Radetsky March—Strangers In Paradise—I Love Paris—Tonight—Petite Fleur—The Last Waltz—Parade Of The Wooden Soldiers. (L.D.S.)

★ ★ ★

GOLDEN HOUR OF CHRIS BARBER AND HIS JAZZ BAND. Astor GH 580 Stereo.

Chris Barber fans will get their money's worth in this release with seventeen of the band's best hits including: Petite Fleur—Tuxedo Rag—April Showers—Everybody Loves My Baby—Lonesome Road Blues—High Society—Bugle Call Rag—Beale Street Blues—Bye And Bye—When The Saints Go Marching In. The vocals are carried by well known English jazz singer Ottilie Patterson.

The only let down with the disc is the relatively poor overall quality but, if you like the tracks, you could probably overlook this. (N.J.M.)

★ ★ ★

DOWN TOWN WITH GRAEME BELL. Harlequin L 25125.

Tracks on this album were recorded in Sydney between 1962 and 1965. It is not designated stereo or mono but there does appear to be some slight stereo spread (or channel difference) at least on some tracks. Recording quality is good and if you like the music of Graeme Bell and his jazz band then this is a good buy.

A list of the tracks comprises: African Waltz – Black And Tan Fantasy – Waterfront Whale – Tin Roof Blues – Margie – Battle Hymn Of The Republic – That's A Plenty – Dixie – Justine – Downtown – Savoy Blues – Down By The Riverside. (L.D.S.)

★ ★ ★

PUT IT WHERE YOU WANT IT. The Average White Band. MCA Records MAPS 7834.

Malcolm Duncan, Onnie McIntyre, Roger Ball, Hamish Stuart, Robbie McIntosh and Alan Gorrie comprise the Average White Band. Rather unexpectedly, their music is better than average, although to my tastes it is a little monotonous. Their basic style seems to be a mixture of rock and jazz, tending towards slow ballads.

The eight tracks are: How Can You Go Home – This World Has Music – Twilight Zone – Put It Where You Want It – Show Your Hand – Back In '67 – Reach Out – T.L.C. (D.W.E.)

★ ★ ★

THE DOVE. Original Movie Soundtrack. Interfusion L35387 Stereo. Festival Release.

A musical travelogue would be the best description of this soundtrack of a movie depicting a round the world yacht trip. Over the main theme which crops up constantly there are touches of music from exotic places. Some of the tracks are: The Dove – Sail The Summer Winds – Here There Be Dragons – Mozambique – Xingmombila – Alone On The Wide, Wide Sea – After The Fire.

The quality is excellent; a pleasant record for background or for relaxing. (N.J.M.)

★ ★ ★

JOHN PAUL GEORGE RINGO . . . & BERT. Original Cast Recording With Barbara Dickson. Stereo, RSO2394 141 SUPER. (Distributed by phonogram.)

"John Paul George Ringo . . . & Bert" is a play by Willy Russell about the Beatles, as told by a fictitious person, namely Bert. This original cast recording is dominated by Barbara Dickson, who sings almost all the songs. Included, amongst these are the following Beatle compositions: I Should Have Known Better – Your Mother Should Know – With A Little Help From My Friends – Penny Lane – Here Comes The Sun – Long And Winding Road – Help – Lucy In The Sky – You Never Give Me Your Money/Carry That Weight – We Can Work It Out – A Day In The Life.

Barbara has a pleasant voice, and her versions of the Beatle classics make very enjoyable listening. In particular, I was very impressed with her version of Here Comes The Sun, which is one of my favourite Lennon/McCartney compositions.

Another track I found interesting was Ooee Boppa, sung by "Tiny Tina and The Titular 3", which concerns one Tommy and a ten-ton lorry full of frozen fish fingers!

Seriously, if you yearn for the nostalgia of the sixties, and are interested in hearing different arrangements of the Beatles classics, then look no further. Recording quality is excellent. (D.W.E.)

★ ★ ★

SALTED PEANUTS. Supersax. Capitol Stereo ST-11271.

This must be one of those albums which some may supposedly buy (I certainly wouldn't) for the titillating cover which portrays two naked "ladies" sitting in a bowl of peanuts and holding a saxophone each. But, for me, the music is largely forgettable and is the sort you would reasonably expect as a background for a cheesecake exhibition.

Recording quality is good, however.

Nine tracks are featured in all: Yardbird Suite – Groovin' High – Embraceable You – The Bird – Lover – Scrapple From The Apple – Confirmation – Lover Man – Salt Peanuts. (L.D.S.)

★ ★ ★

HARMONICA FAVOURITES. The Dargies. Stereo, Astor ALPS-1040.

Probably because, in my younger days, I could coax a tune from a mouth organ, I have always had some admiration for those who could play the instrument really well. And the Dargies must certainly be included in this number. Harmonica players in the group include Horrie Dargie, Doc Bertram and Vern Moore. Additional support comes from Vern Moore (also guitar and flute), Clyde Collins (piano and organ) and Neil Wilkinson (drums, vibes and tympani).

With that line-up, the Dargies are in a position to produce a varied and well rounded group sound, and this they do in a program of no less than fourteen tracks. Tie A Yellow Ribbon – Ritual Fire Dance – The Summer Knows – Norwegian Mood – Sabre Dance – The

LIGHTER SIDE

Mule – Theme From "Shaft" – The Entertainer – Ravel's Bolero – Theme: "Last Tango In Paris" – 24 Hours From Tulsa – Pink Panther – Lonely Love – A Time For Us.

The quality is good and, provided you don't actively dislike harmonicas, here fully backed, you'll enjoy this latest program from the well known Dargies. (W.N.W.)

★ ★ ★

WILL UPSON BIG BAND LIVE AT PINOCCHIO'S. Harlequin L 25183.

Will Upson leads a 20 piece "big band", which plays regular "gigs" at a Perth nightclub. This live recording features the following tracks: T.S.O.P. – Pardon Me Sir – Killing Me Softly With His Song – Get Down – Roger's Blues – Alone Again (Naturally) – 2001 (Also Sprach Zarathustra) – Skybird – The Letter.

All the arrangements are good, as is the recording quality. In fact, it is only the applause at the end of each side that marks this out as not being a studio recording. If you are a big band fan, then this record would be a good addition to your collection. (D.W.E.)

★ ★ ★

SCOTT JOPLIN'S 'MAGNETIC RAG'. The Southland Stingers with Ralph Grierson at the piano. EMI Release OCSD7712.

If you are a collector of old rags this record would be a useful addition. Scott Joplin's posthumous fame has been enhanced no end by the use of some of his music in the movie 'The Sting', the name of the group involved in this record having such a connotation. The quality on the ten tracks is above reproach, the titles being: Magnetic Rag – Elite Syncopations – Heliotrope Bouquet – The Nonpariel – Lily Queen – The Strenuous Life – Bink's Waltz – The Sycamore – Eugenia – Something Doing.

The music is very danceable for the oldtime style; in short, very easy to listen to. (N.J.M.)

★ ★ ★

I HEAR MUSIC. Stephane Grappelli. RCA Victor Stereo VPL1-7038.

Some very relaxing music from the world's top jazz violinist is featured on this disc. As a sidelight, one track features Grappelli on the piano. Record quality is excellent.

There are eleven tracks: Tea For Two – Danny Boy – Let's Fall In Love – Coltrane – Dear Ben – I Hear Music – Dany – Smoke Gets In Your Eyes – Body And Soul – Gary – Flower For Kenny. (L.D.S.)

★ ★ ★

PETER PICCINI'S ORGAN HIT PARADE. Hammond Organ. Stereo, Clarion 2-record set (Festival) L-45535/6.

Imagine that you're enjoying a relaxed meal in a softly lit restaurant and, over in one corner, an organist is playing along in a manner gently rhythmic and at a carefully controlled level. You hear it, you probably like it, yet you don't consciously listen!

Well, that is what this double album is all about: gentle organ background for eating, reading, relaxing. There are 20 numbers on the four sides; numbers like: Another Time, Another Place – Spanish Harlem – Banks Of The Ohio – It's Too Late – It's A Sin To Tell A Lie – Candy Man – Where Is Love? – Don't Walk Away – Superstar – Ranger's Waltz . . . and so on.

Peter Piccini makes it all sound very easy and, while the Hammond produces exactly the sounds he needs, it doesn't try to be a demonstration of organ voices. The sound and surface is completely clean and there's not even the stray click to disturb your reverie. (W.N.W.)

IN A COUNTRY MOOG. Gil Trythall and his Moog Synthesizer. Interfusion Stereo. L-45,557/8.

This is a double album set featuring twenty-two country-style tunes played on a Moog synthesizer. Included among the titles are Folsom Prison Blues – Harper Valley P.T.A. – Gentle On My Mind – Little Green Apples – Wichita Lineman – I Can't Stop Loving You – King Of The Road – to mention only a few of the more well known ones.

There are quite a few aural surprises in this collection, as Gil does his thing. On the whole, the album is quite pleasant listening although, after such a large number of tracks, one tends to become a little bored. However, if you fancy a "different" style of country music, then this could be a good buy, as the quality is excellent, with some good stereo effects. (D.W.E.)

★ ★ ★

GOLDEN MELODIES. Joseph Seal, Wurlitzer pipe organ. Stereo, Astor GGS-1447.

Yet another in his recent series of recordings, this album by veteran theatre organist Joseph Seal was made on a 3-manual instrument that was once installed in the Regent Theatre, Kingston-on-Thames. It is now a prime exhibit in the Musical Museum at Brentford, Middlesex.

The "Golden Melodies" presented here are, for the most part, musical museum pieces of the theatre organ era: Liberty Bell – Over The Rainbow – Jolly Brothers Waltz – Getting Sentimental Over You – Chasing Moonbeams – Cavalleria Rusticana – Alicante – Jeannie With The Light Brown Hair – Voices Of Spring – All-Time Hits Medley – Dance Of The Hours Ballet.

Joseph Seal plays as competently as one would expect a musician of his experience to do, with variations sufficient to remind one of traditional Wurlitzer voices and moods. To get the intended impact it is essential to play the disc at a reasonable level and this will expose some surface prickles and a high level of ambient noise on the tape master which is mercifully turned down between tracks. Overall: pleasant enough but scarcely exciting. (W.N.W.)

★ ★ ★

MUNGO JERRY'S GREATEST HITS. Astor Golden Hour Stereo GH 586.

Included among the seventeen songs on this collection are: In The Summertime – Lady Rose – You Don't Have To Be In The Army To Fight In The War – Have A Whiff On Me. For Mungo Jerry fans, this must represent good value, as the recording quality is excellent.

Unfortunately, there was one facet of the record which I found disturbing. On the second side, which contains a total of nine tracks, the last track extends quite close to the label, with the result the automatic return on my turntable refused to operate. This means that the tonearm must be manually returned to its rest position. This minor irritation is obviously a direct consequence of the long (1 hour) playing time of the record. (D.W.E.)

★ ★ ★

AUSTRALIANA

". . . skilfully performed"

ONCE A JOLLY SWAGMAN. Ted Egan. Stereo, RCA Victor VPLI-0049-G.

Fronted by a somewhat less than professional sketch of a swagman, printed in a single colour, "Once A Jolly Swagman" might well be taken as a not very ambitious collection of Australiana. But the first few bars are sufficient to indicate just the opposite. It's up-tempo and updated, unmistakenly Australiana, but skilfully performed and superbly recorded. Perhaps it's not surprising, noting that production is by Ron Wills.

The thirteen tracks are entitled: Waltzing Matilda—The Bagman's Bicycle Blowout—Cattle Going In—Greasy Biggins—Torres Straight Medley—That Day At Boiling Downs—The Man From Humpty Doo—The King V. August Paul—The Urapunga Frog—Arnhem Land Lullaby—Bardikan The Cockatoo—Moreton Bay—Alice.

Listening to track after track, I couldn't help but feel that this was Australiana that would have a strong overseas appeal. Then the penny dropped: it's the kind of material which has been popularised by Rolf Harris but there the comparison should end. Ted Egan is not an imitation Rolf Harris, he's a fine performer in his own right and, if you have any interest at all in this type of material, you should sample a few tracks of this new album. (W.N.W.)

NICE TO BE AROUND. Maureen McGovern. 20th Century L-35,199.

Most people will remember Maureen McGovern from her theme song from one of the recent "disaster movies". The title song from this album, "Nice To Be Around", is also from a film, titled "Cinderella Liberty". Other titles included are: Give Me A Reason To Be Gone—Where Did We Go Wrong—All I Want (All I Need)—Like A Sunday Morning—Love Knots—Everybody Wants To Call You Sweetheart—Little Boys And Men—Memory—Put A Little Love Away.

Maureen has a pleasant voice, well suited to the love ballads which predominate on this record. The recording quality is excellent, and the accompaniment is pleasant without intruding. If you like this type of music, then this would represent a good buy. (D.W.E.)

★ ★ ★

ALL ABOUT A FEELING. Donna Fargo. Dot Records L-35065.

Donna Fargo sings about love, and she has the talent to express her true inner feelings. All the songs on this album are her own compositions, and listening to them, one does indeed learn "all about a feeling".

Her rather plaintive voice has a knack of reaching right inside you, and evoking responses that you may have thought suppressed. This is definitely not a record to provide background music, rather it should be listened to carefully. I found that after each playing Donna's sincerity tended to grow on me.

If you like her style of communication, otherwise known as getting down to the heart of the matter, then this effort by Donna must surely represent a worthwhile investment. Have no fears about technical quality; I could not fault it. (D.W.E.)

★ ★ ★

NEWCASTLE SONG. Bob Hudson. Stereo. M7 Records MLF 083.

'Ere's one for all youse ocker fans; Bob Hudson's Newcastle Song, recorded live in concert. With such other titles as: Living It Up On The Dole – R Certificate Song – I Never Was Born Like Mel – as well as the Newcastle Song itself this is a sure-fire hit at a party, or wherever else you can find to play it.

For reasons that will become obvious, this record should not be played in genteel company, as the subtle innuendoes and satirical songs may not be universally approved.

Aided by such notables as Paul Hogan and the Remand Centre Old Boys Choir, Bob (Abraham Luigi) has produced what must be a classic Australian effort. Characters such as Jonathon Livingston Budgerigar and Normie will surely join the ranks of other compatriots such as Ned Kelly and Barry Mackenzie.

A word of warning: the last line of the "R Certificate Song" is repeated in a way calculated to deceive the listener into thinking his pickup is jumping tracks. Don't make a grab for the arm, otherwise you may miss and really do some damage. What a spoil sport I am! (D.W.E.)

ELECTRONIC AGENCIES

BIG SAVINGS on CCTV...

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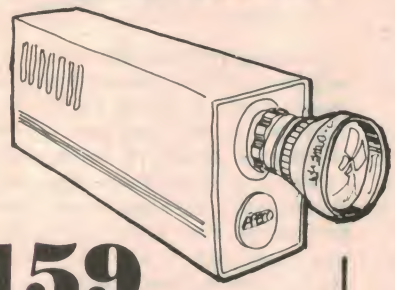

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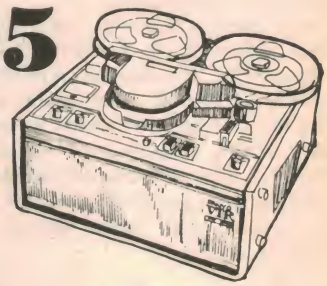

Sanyo VTR-2000. Records video and audio signals on ½" tape (1hr) — features auto level controls for easy operation. Record from home TV or camera, play back on home TV. Completely portable (29lbs).

CONCORD TV CAMERA

With in-built monitor/viewfinder. Lets you see what the camera sees — great when you have to follow a moving target as in sport, etc. Use as playback monitor with Video Tape Recorder etc. Normally $650.

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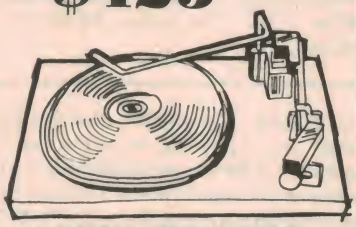

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With remote controller. Easily adjustable from 45 deg. to 360 deg.; sweeps desired area and reverses automatically. Remote controller permits manual operation from a distance.

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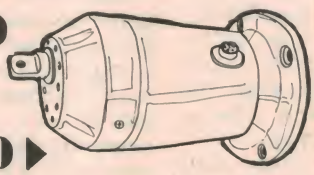

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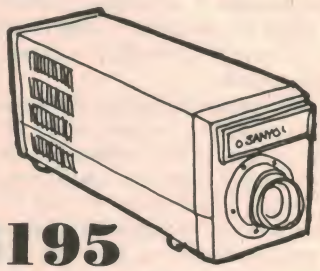

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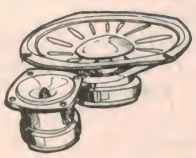

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$14.50 ea.

(2) Plessey 12" 2 way package deal C12P/&X-20 30W RMS 8 ohms.

$24.95 ea.

(3) Imported 8" De-luxe 2 way. 8" 2" 25W RMS 8 ohms.

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(4) MSP 3 Way 8" Package Deal. 8" 5" 3" 20W RMS 8 ohms.

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(5) Plessey 12" 3 Way package deal. C12P KC5NR X-30. 30W RMS 8 ohms.

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(6) Imported 10" De-luxe 3 Way. 10" 4" 2" 30W RMS 8 ohms.

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(8) De-luxe Dome System 3 Way. Imported 12" plus dome mid, tweeter 30W.

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(9) Imported 12" 3 Way system. 12" 6" 3" (x2) 30W RMS 8 ohms.

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All kits include cross over components and wiring diagrams.

PA, CB or ham BASE STATION MICROPHONE KIT

50 ohms impedance (10K with transformer $6.50) and includes press-to-talk switch DPDT, spring return.

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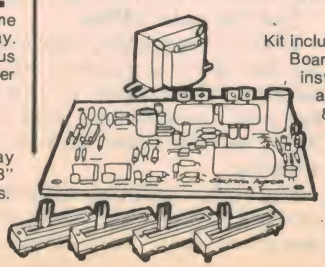

Kit includes transformer, labelled and numbered P.C. Board, all Resistors and Capacitors, 4 pages instructions. Amazing offer for "hi-fi-ers" — Stereo amplifier kit, giving 15W RMS in 4 ohms, 10W RMS in 8 ohms (per channel) with 5 mV magnetic cartridge input VOLUME, BALANCE, BASS and TREBLE controls supplied — latest integrated circuit pre-amp and driver stages, complementary "flat-pack" output transistors — all on one P.C. Board for easy assembly. Hi-Fi performance with 20Hz to 50kHz response, low distortion and low hum level ensure compatibility and the best turntables and speakers. Complete Kit $30 plus post.

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4. 20ft. Single Shielded Cable — high quality grey. **$1.00.**
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6. 4 — Alignment Tools — useful radio/T.V. types. **$1.80.**
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9. Bonanza Jackpot — a wealth of all types of electronic parts for the Hobbyist/Experimenter. $25 value for only **$5.00.**
10. 2-Way Intercom — Master/Slave with 50ft Cord. **$10.95.**
11. 50ft Plastic spaghetti tubing — asstd. sizes/colours. **$1.00.**
12. Crystal Microphone) high imp. 200-6000 Hz. **$1.95.**
14. 25ft Nylon Dial Cord — c/with 5 dial springs. **$1.00.**
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16. 5-NE 2 Neon Bulbs — 60V operation, 100's uses. **$1.00.**
17. 10 — Volume Controls — some with switch, ganged. **$1.00.**
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21. P.C.B. Etching Kit — all the requirements including P.C.B. to make professional P.C. Boards. **$2.95.**
22. 2-2 Pin Din Plug/Sockets — best quality. **$1.00.**
23. 2-5 Pin Din Plug/Sockets — cheapest and best. **$1.20.**
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25. 12 — No. 216 Battery Clips — High Grade types. **$1.00.**
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44. 1 — Strobe Tube and Trigger Transformer — matched set, high output. **$6.95**
45. Remote Control, T.V. Listener — easy to install device for private listening and for hard-of hearing persons — outputs for 2 earphones (not incl. but available at 50c each) with volume control. **$3.50.**
46. Extension Speaker Box — high quality hi-fi speaker box c/w volume control and 5" dynamic speaker 5W. Size 230 x 140 x 125mm, giving a beautiful clear sound. This is the deluxe model with aluminium trim. SP4. **$13.50**
48. Wall mounting Extension Speaker — front panel slopes downwards for wall mtg at approximately 6 — 8ft. high. Uses a super 5", 5W speaker and includes volume control. Size 240 x 165 x 95mm. Finished in imitation wood-grain vinyl. SP2. **$12.50.**
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55. Speaker Selector Switch — surface mounting for horizontal or vertical operation. Allows 3 pairs of speakers to be switched in 7 different combinations, e.g. one on, two on, one and two on etc. Its simple to wire your whole house for hi-fi sound in every room. B2. **$8.25.**
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59. Car Stereo Speakers — 5" heavy duty 4-5 Watt Speajers mounted in a handsome black plastic sloping-front cabinet for rear shelf operation in all types motor cars. Avail. in 4 or 8 ohms imp. Supplied with mtg. screws and connecting wire. SK709. **$11.80 pr. or $6.25 eac.**

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60. Car Stereo Speakers — flush mounting with long-life chromed grille. Incorporates 5" speaker of 4-5 Watts handling power. Available in 4 or 8 ohms impedance. Supplied with mounting screws and connecting wire. GK705. **$11.80 pr/ or $6.25 ea.**
61. Car Stereo Speakers — same as above but with handsome black, soft vinyl grille and black plastic frame. GK705V. **$12.50/pr. or $6.95 ea.**
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63. Top Cowl Car Antenna — a high quality fender mounting car radio antenna finished in gleaming chrome with approx. 6ft lead-in. **$3.25.**
64. Lock-Down Car Antenna — beat the vandals with this superb lock-down car radio antenna. Extra high quality chrome finished — extends to 40 inches c/w approximately 6ft. lead-in. **$3.95.**
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66. Motorised Car Antenna — press the button and up it goes — press again and it retracts — thief-proof and trendsetting. Operates from 12 volt only, suits pos. or neg. ground. Guaranteed best quality. **$16.95.**
67. Crystal Microphone — a lapel or hand-held microphone for small tape recorders and hobbyist projects. Supplied with 3.5mm earphone type phone plug. MG62. **$1.95.**
68. Crystal Microphone — quality mic. for hand-held or table operation — suit most tape recorders and hobbyist projects, c/w 3.5mm plug. MC22. **$3.20.**
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70. Deluxe Dynamic Microphone — same as above but includes high quality dynamic insert and transformer for high impedance 50K ohms. MD402. **$8.50.**
71. Dynamic Microphone — attractive high impedance (50k ohms) microphone for hand-held or table operation. Suits most tape recorders etc. MD391. **$5.99.**
72. Dynamic Cassette Type Microphone — a low impedance (200 ohms) dynamic mic. for use with most types cassette tape recorders — features on-off switch for remote control of tape recorder if required. For hand-held or table operation — comes complete with 3ft lead and "earphone-type" 3.5mm plugs. Freq. response 200Hz to 10kHz. A real bargain. MD17. **$3.25.**
73. Deluxe Hi-Fi Dynamic Microphone — this omni-directional hand-held ball type microphone has a die-cast housing of satin chromed finish, on-off switch, mic. holder and approx. 9ft. shielded cable. Would suit high quality tape recorders, PA or singing use, store advertising or G.P. applications. Imp. 50k ohms, freq. response 100Hz to 10kHz, sensitivity — 58 dB at 1000 Hz, c/w 20ft. lead and 6.5mm phone plug. MD109. **$16.95.**
74. Crystal Mono Cartridge — suit most imported record players. M110. Cat. No.12-200-010. **$1.95.**
75. Ceramic Mono Cartridge — as above. MC110. Cat. No. 12-200-011. **$1.95.**

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D 25-Asst Electrolytic Capacitors (all new)

E 2-micro-miniature 3 pin (gold) plugs/sockets

Books & Literature

Colour servicing

COLOUR TV SERVICING, by Gordon J. King. Published by Newnes-Butterworth. Hard covers, 342 pages, 150 x 247mm. Photographs, line drawings and colour plates. Price in Australia $12.00.

This is the second edition of this book, the first edition being published in 1971 and reviewed in these pages in May 1972. The major changes in the second edition appear to be the addition of one chapter (17, Receiver Design Trends) and a large multicoloured foldout fault finding chart.

Doubtless there has been minor updating in other parts of the book but, in general, the impression is one of a straight reprint. In fact, judging from the illustrations of typical British receivers and circuits, it would appear that there has been very little change on the British colour TV scene since 1971. Either that or the book has not been updated as fully as it might have been.

Be that as it may, this is still a very good book. While aimed specifically at the service technician, the author obviously believes that a good grasp of basic theory is a necessary prerequisite to efficient practical servicing. As a result, the first part of the book is devoted to theoretical background, as indicated by the chapter headings: 1, Introduction. 2, The Science of Colours. 3, The Colour Camera, Signals and Displays. 4, The Shadowmask Colour Tube. 5, An Overall View of the Colour System.

Concentration of this amount of subject matter into a mere five chapters means, inevitably, that it will be less detailed than a textbook devoted entirely to theory. Nevertheless the author has done a particularly good job in concentrating on the essentials to give a good basic background to the whole subject. Chapter 2 (The Science of Colours) is especially well handled.

The next five chapters deal with practical circuits as found in typical colour sets: 6, Purity and Convergence. 7, Timebases, EHT and Power Supplies. 8, Luminance and Colour Difference Amplifiers. 9, Vision, Chroma, Reference Generator and Sound Stages. 10, Encoding and Decoding.

Each of these chapters deals with the requirements which each section of the set has to meet, typical circuits, both valve and transistor, and the various adjustments which are normally required. In this latter regard, the chapter on convergence is probably the most extensive, due to the quite complex routine normally required for convergence adjustment.

Chapters 11 to 16 are devoted to practical servicing: 11, Test Instruments and Signals; 12, Locating the Fault Area; 13, Servicing Procedures; 14, Servicing in the Field; 15, Tuned Circuit Alignment, 16, Faulty Picture Tube Symptoms.

Chapter 17 (Receiver Design Trends) is obviously aimed at updating the main material as much as possible. It deals with such trends as the increasing use of ICs, modules and plug-in boards, vertical slit picture tubes, as well as the more modern circuit design trends.

Chapter 18 lists world television standards, with some comments about specific areas.

The book is well written, in plain language, with a minimum of mathematics. While some of the references, eg, to dual standards, are peculiar to the British scene, these are easily disregarded. On the other hand, the British standards are so similar to our own that the student needs to make very little adjustment.

Altogether, a worthwhile addition to any serious student's library.

The review copy came from Butterworths, 586 Pacific Highway, Chatswood, NSW, 2067. (P.G.W.)

Batteries

STORAGE BATTERIES AND RECHARGEABLE CELL TECHNOLOGY, by Louis F. Martin (Ed.). Published by Noyes Data Corporation, Park Ridge, New Jersey, U.S.A. Hard cover, 364pp 234mm × 155mm. Illustrated with line diagrams. Price in USA $36.00.

This would seem to be a highly specialised book which, by reason of its relatively high cost, is more suited to the reference library than the individual's bookshelf. It is not a text book in the normal sense, rather a reference book. The editor's foreword probably sums it up best.

"The detailed, descriptive information in this book is based on U.S. patents since the middle 1960s relating to storage batteries and rechargeable cell technology."

He goes on to explain that the significant technical information only has been extracted from these files, "...

eliminating legal jargon and juristic phraseology".

The book is divided into seven subsections: Lead-acid Storage Batteries; Alkaline Batteries; High Energy Density Cells; Zinc Cells and Electrodes; Fuel Cells; Thermal Batteries; and Other Electrodes, Cells, and Batteries. There is a three section index; by company name, inventor's name, and U.S. Patent number.

As might be imagined, the various descriptions deal mainly with industrial processes, rather than basic principles but, nevertheless, interesting technical information can often be found in such descriptions, particularly where it is necessary to explain the limitation of an existing process to justify the new one.

But this is not the book's intended role. It would be most valuable to anyone pursuing a particular line of research and who needed to know what had already been done in order not to waste time in duplicated effort. It would also give a clear picture of the patent situation in the event that he wished to lodge his own claim.

It should also be noted that the type face used, while quite readable, is smaller than usual, meaning that there is a lot of information packed into the 360 odd pages.

The review copy came direct from the publisher. (P.G.W.)

Vertical antennas

THE AMATEUR RADIO VERTICAL ANTENNA HANDBOOK, by Capt. Paul H. Lee. Cowan Publishing Corp, New York, 1974. Soft covers, 228 x 152mm, 136pp, many illustrations. Price in Australia $7.10.

This is a recent addition to the books published by the people who produce the well-known US amateur radio magazine "CQ". It brings together in updated and revised form the material written for CQ over the last 22 years or so by the long-time champion of vertical antennas, Captain Paul H. Lee, USNR, K6TS.

There are a total of 20 chapters, which deal in turn and at length with basic design principles, important parameters such as directionality and bandwidth, matching, variants on the basic idea, and practical designs. Some four fully practical antennas are described, together with feed systems, remote control facilities and earthing systems.

The book also contains a section giving common questions and queries about vertical antennas, together with answers.

Throughout the book the text is written in clear and easily readable language, yet with sufficient theory and formulae to satisfy the reader who wants to go into the subject more deeply than is needed for practical construction.

The review copy came from Technical Book and Magazine Co of 289-299 Swanston Street, Melbourne Vic, who advise that they have copies in stock. (J.R.)

New Products

Sinclair digital multimeter

A valuable instrument in any service vehicle or workshop is the digital multimeter. Once restricted by high price to more specialised applications, these are now available at prices comparable with the more conventional instruments having similar facilities.

Compared with the moving coil based instruments, the digital multimeter offers the advantages of a high inherent accuracy, an unambiguous display which can take advantage of such accuracy, a high order of sensitivity, a relative freedom from overload damage, and the absence of a delicate mechanical movement with its risk of physical damage.

The Sinclair DM2 Multimeter. It is light and compact; ideally suited to replace the older style multimeter on the bench or in the field.

One of the currently available instruments of this type is the Sinclair Multimeter DM2, marketed by Dick Smith Pty. Ltd. A completely self-contained battery operated instrument it would seem to be ideally suited as a general purpose instrument, either on the bench or in the field. It measures 235 x 160 x 57mm and weighs only 0.9kg.

The case is of heavy gauge aluminium which should be capable of withstanding a lot of hard work. It is fitted with a carrying handle which doubles as a bench stand, to set the front panel at a convenient viewing angle.

There are four DC voltage ranges (1 to 1000), four AC voltage ranges (1 to 500), four DC current ranges (1mA to 1A), four AC current ranges (1mA to 1A), and four resistance ranges (1k to 1M).

Two additional ranges are available by slightly more complex juggling of the controls. A fifth resistance range extends measurement to 10M, and a fifth current range extends measurement downwards to 100uA.

Considering the wide range of facilities, operation has been made commendably simple. There is only a single pair of input terminals, all range selection being by locking type push buttons. These are in two groups, a group of four providing range selection—1, 10, 100, 1000—and a group of five providing selection of V & mA AC, V & mA DC, and the resistance range. An additional single button selects either the internal battery or an external power supply, if connected.

The input impedance for all the voltage ranges, AC and DC (except 1V DC) is 10M. For the 1V DC range it is greater than 100M. On the DC current ranges the impedance varies from 1k on the 1mA range to 1 ohm on the 1A range.

These current range impedance figures warrant some comment. They are high by many standards—10 times higher than those available from mechanical meter movements—and could result in misleading meter readings and/or circuit behaviour in some circumstances. Where extensive use of these ranges is contemplated, this limitation should be kept in mind.

Frequency response on all AC ranges (except 1V) is 20Hz to 1kHz. For the 1V range it is 20Hz to 3kHz.

The readout uses a three and a half digit display, ie, reading to 1999. The digits are 8mm high and the display is fitted with a filter to increase contrast. Polarity indication is by a negative sign where appropriate; absence of a sign indicates positive polarity. Overload of the selected range results in all digits reverting to zero except the extreme left hand one, which displays a flashing symbol.

Price of the DM2 is $139.00, including a battery. A carrying case is available for an extra $6.00. Further details from Dick Smith Pty. Ltd. (P.G.W.)

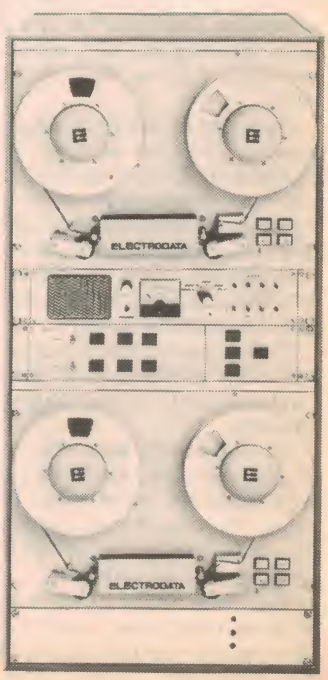
Electrodata logging tape recorder

Electrodata Associates Pty Ltd, 18 Coward St, Mascot, NSW, is pleased to announce a new range of communications tape recorders—System 8400 for logging voice communication channels over extended periods of time.

Designed and built in Australia to the highest international standard of workmanship and performance, the System 8400 comprises three basic dual deck models for recording 8, 16 and 32 channels on ¼ in, ½ in and 1 in tape respectively. In addition, a range of lower priced, single deck recorders are available for applications where some interruption to recording every 24 hours may be tolerated, in order to change tapes.

Typical applications range from single channel recording at radio and TV studios to multichannel recording at air, land and marine traffic control centres.

A wide range of optional facilities, plus modular construction, enables these recorders to be assembled to suit virtually any customer requirement. Local design ensures a complete after sales service.



VHF & UHF power modules

Two compact new RF power modules from Willis Communications should be of particular interest to radio amateurs working FM or CW on the 144MHz and 432MHz bands. One is a straight 2m amplifier, the other a tripler amplifier to give 70cm output from 2m input. Both operate from 12V DC, and are thus very suitable for mobile work.

Both modules use three "capstan" type RF power transistors, with the circuitry on a compact PC board mounted inside a die-cast aluminium box measuring 65 x 130 x 35 mm. Input and output are via BNC connectors, while the power connections are made via colour-coded heavy-duty figure-8 plastic flex which enters the case via a grommetted hole. A U-shaped heatsink bracket is used to assist in dissipating away the heat, to ensure reliable operation.

The modules are designed for an impedance level of 50 ohms at both input and output, and are rated at an input DC level of 13.8V.

The 2M amplifier module is designed to produce more than 25W output from an input of approximately 200mW. It uses fairly conventional circuitry with a 2N5589-90-91 lineup. As with all VHF circuits, however, the secret's in the fine details, and the layout.

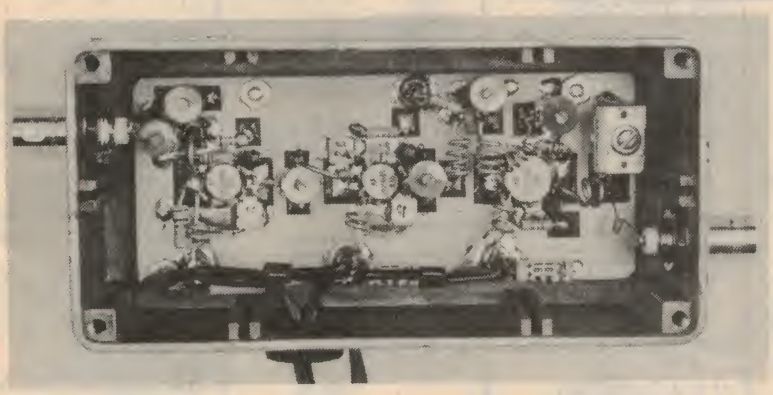
The 432MHz tripler-amplifier module is almost identical in its appearance to the straight amplifier, except for the legend "UHF" engraved on the case. In this case it is designed to accept about 200-300mW at 144MHz, and produce more than 10W output at three times the input frequency. The transistor lineup is 2N5589-2N5945-2N5946, with the first stage as an active varactor tripler. Again, the secret is in the precise details of layout and component values.

Both modules come complete with an instruction sheet giving the full circuit and detailed tuning instructions, together with a wiring diagram to permit easy identification of all trimmers, etc. This, together with the construction and layout of the modules themselves, suggests that they have been very carefully planned and executed.

A sample of each module was tested in our laboratory, not just for power gain and output, but also for stability and ease of adjustment. We found them both highly stable, with no hint of spurious operation when the maker's tuning procedure was carried out to produce maximum output.

Both units gave a clean output, even when driven with an RF input 50% greater than their rated input. With rated input, they both easily met and exceeded the minimum output figures claimed. In fact both modules also delivered their rated minimum output into 75 ohm loads, when readjusted, with the nominal 13.8V supply. Even with the supply reduced to 12.8V the VHF module still delivered 23W into 75 ohms, and the UHF unit 13W into 75 ohms, with no embarassment evident.

At right is an external view of a module, while below shows inside the 70cm unit.



In short, the modules came through our tests with flying colours, and would appear to be very well made little units. They should be ideal both for mobile VHF-UHF enthusiasts, and for those seeking a simple way of producing a medium power fixed FM rig. Add a simple exciter unit, and you're ready to go!

Price of the straight 2M amplifier is $42.00, and the tripler-amplifier $52.00, plus $1.50 in each case for packing and postage. Both come fully tested and tuned up.

Further enquiries to Willis Communications Pty Ltd, 13 Bishop Street, Kelvin Grove, Qld 4059. (J.R.)

NEW PRODUCTS

AWA 14in colour portable

Those seeking a compact colour TV receiver should find the AWA model C609 an attractive proposition. With a nominal 14-inch diagonal screen, it offers a black matrix in-line gun tube, provision for UHF reception, automatic fine tuning and a "quick start" facility.

The AWA model C609 colour receiver is marketed by AWA-Thorn Consumer Products, who also market an almost identical set in their Thorn range—the model 9038. I understand that both models are fully imported from Japan, being manufactured by Mitsubishi.

The model C609 receiver is a compact and attractively styled set, suitable for use either in a small loungeroom or as a carry-around portable. It is housed in a case moulded from high-impact plastic, which measures 496 × 412 × 418mm (W × H × D) and weighs 19.3kg. The case is complete with twin telescopic aerials, for use when a more elaborate aerial is either unavailable or unnecessary.

The set fully conforms to the standards laid down and recommendations of the SAA and ABCB, even to the extent of having an inbuilt UHF tuner to allow reception of channels 21-68 when services extend into this part of the spectrum. As supplied the UHF tuner is not activated, but this may be done at any time by means of a simple modification—which disables VHF channel 5, incidentally.

The picture tube used is of the newer generation vertical-stripe type, with in-line guns and a black matrix screen. The latter offers good colour contrast and brightness, while the former results in considerable simplification of the convergence hardware and setting-up procedures. It also makes the set more stable in adjustment, and more reliable.

In fact the C609 has no dynamic convergence adjustments at all, presumably as a result of the use of a close-tolerance yoke together with a conservative 90° deflection angle. The sole convergence adjustments are four static magnet rings, positioned between the yoke and purity magnet rings. Setting up is thus a very simple and rapid procedure.

Apart from the picture tube the set is fully solid state, with 4 IC's, 50 discrete transistors and 62 diodes. Power consumption is 95W, and the power supply uses a conventional power transformer and bridge rectifier combination.

The receiver has a "quick start" facility, whereby the picture tube heaters are still energised at reduced power when the rest of the set is turned off via the main on-off switch. This gives a much reduced time from switch-on to the appearance of a picture on the screen—about five seconds. However it still takes another ten seconds or so before the picture fully stabilises in terms of colour values.

The quick start facility may be circumvented, if desired, by using a master power switch located beneath the picture tube escutcheon, alongside the less often used viewer controls. These include the vertical and horizontal hold, brightness, contrast and colour saturation.

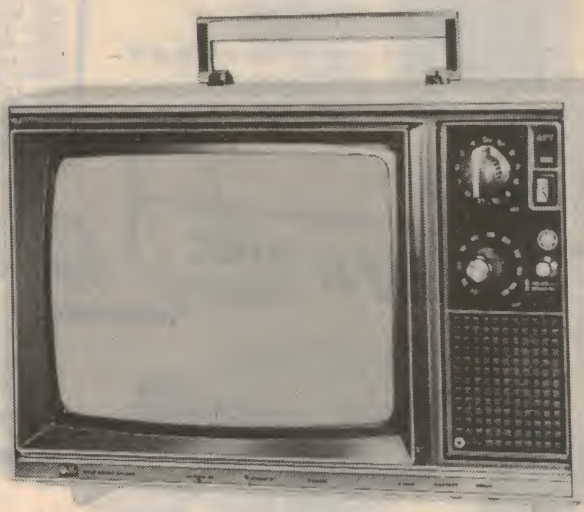
The main control panel above the speaker grille provides the VHF and UHF tuning controls, volume-on/off, and the control button for the automatic fine tuning (AFT). Preset VHF manual fine tuning is by a small knob concentric with the main VHF tuning.

Audio power output is 1W, feeding normally into an internal speaker of 100mm diameter. An earphone socket is provided, which disables the speaker when a plug is inserted.

AWA-Thorn made a sample of the model C609 receiver available to us for test, and this reviewer was able to run it through its paces for a couple of weeks in a typical home situation. It gave a very good account of itself, from the moment it was taken out of the box and connected to the power and an aerial.

No attempt was made to carry out any technical setting-up, as this appeared to be quite unnecessary. Convergence was well within accepted standards, as was colour purity, geometry and masking. The receiver appeared to have high gain and low front-end noise, and in general gave excellent colour pictures on a wide variety of program material.

My only complaint is that the colour saturation control was critical to adjust, with settings for realistic flesh tones cramped right down near the "hop on" point of the pot. This may have been due to an internal misadjustment, however.



For those seeking a compact colour TV receiver, the AWA model C609 offers many attractive features including a UHF tuner and vertical stripe colour tube.

In all other respects the C609 appears to be a very attractive set, well engineered and capable of high performance. For those seeking a compact colour receiver, it would seem good value for money at the suggested retail price of $495.

The C609 and the other models in the AWA-Thorn range should be available generally from all dealers and department stores. (J.R.)

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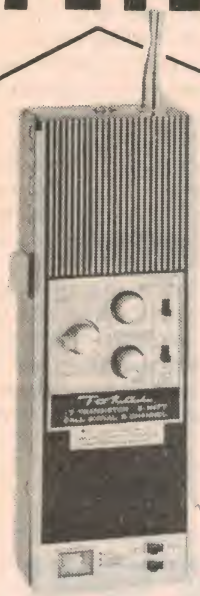

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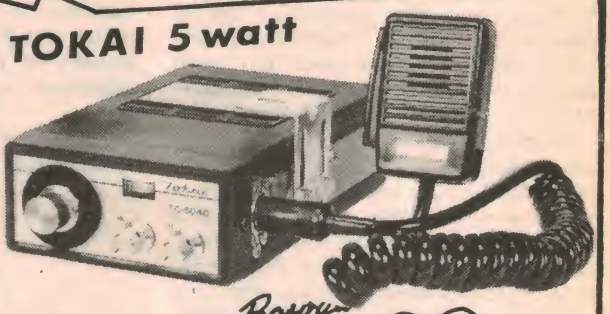

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What's new in Solid State

One-chip ultrasonic transceiver

Possibly the most interesting news on the solid state front this month is the release by National Semiconductor in the US of a special monolithic IC chip which performs all of the active functions required for an ultrasonic transceiver unit. Called the LM1812, its obvious applications are in marine depth sounders and fish finders, non contact ranging and level sensing in air, collision avoidance and intrusion alarm systems.

The device uses novel circuitry to eliminate the costly alignment adjustments often required in such equipment. Only one external L-C network is used for both transmitter and receiver, which not only reduces parts count and alignment labour, but also ensures that the two sections are automatically tuned to the same frequency, irrespective of the transducer used.

The LM1812 operates from a 12V battery and needs only a transducer and display system to produce a complete sonar or sodar system. If the display system uses the conventional motor-driven disc with neon lamp and reference magnet with pickup coil, the chip provides all of the active components for the complete system. Additional circuitry is only required for alternative displays, such as a digital or CRT display system.

Output capability of the transmitter section of the chip is 12W, in pulses of 1us duration. Despite this the chip is in a standard 18-pin DIL package, and does not require a heat sink. Input sensitivity of the receiver is typically 200uV P-P, and the receiver is automatically desensitised during the transmit pulse. It generates a "zero reference" output coinciding with the transmit pulse, as well as the return pulse.

An additional feature of the LM1812 is that it is provided with special access pins to facilitate operating an audible alarm when an echo is received falling within a presettable maximum range.

The basic circuit for a marine depth sounder using the device is reproduced here from the National data sheet. No information is available as yet regarding local price and availability, but the LM1812 will no doubt reach the local scene before very long.

Another interesting new release from National Semiconductor is a pair of precision buffered voltage reference sources, type LH0070 and LH0071. The first of these has an output of 10V, for use in D-A and A-D converters using BCD digitising, while the second has an output of 10.24V for similar systems using binary digitising.

Basically the devices are very similar to a 3-terminal regulator. The difference is that the output voltage is set very precisely during manufacture, by trimming highly stable thin-film resistors on the chip. And the design is such that the voltage remains very stable in the long term.

Both devices are available in three tolerance versions, with typical output voltage tolerances of .03, .02 and .01%. Temperature dependence of the three versions is very impressive, at .02, .01 and .008% respectively for a change from −25 to +85°C. Line regulation is also very good, with figures of .02, .01 and .01% for an input change of from 13V to 33V. Output resistance of all versions is less than 1 ohm, and typically 0.2 ohms.

Both devices come in a TO-5 metal can package and are internally protected against overload in both the current sourcing and sinking directions. They have a standby current of only 3mA and zener noise of typically 100uV P-P.

The cost is quite moderate, with the two wider tolerance versions less than $10 in 1-off quantities.

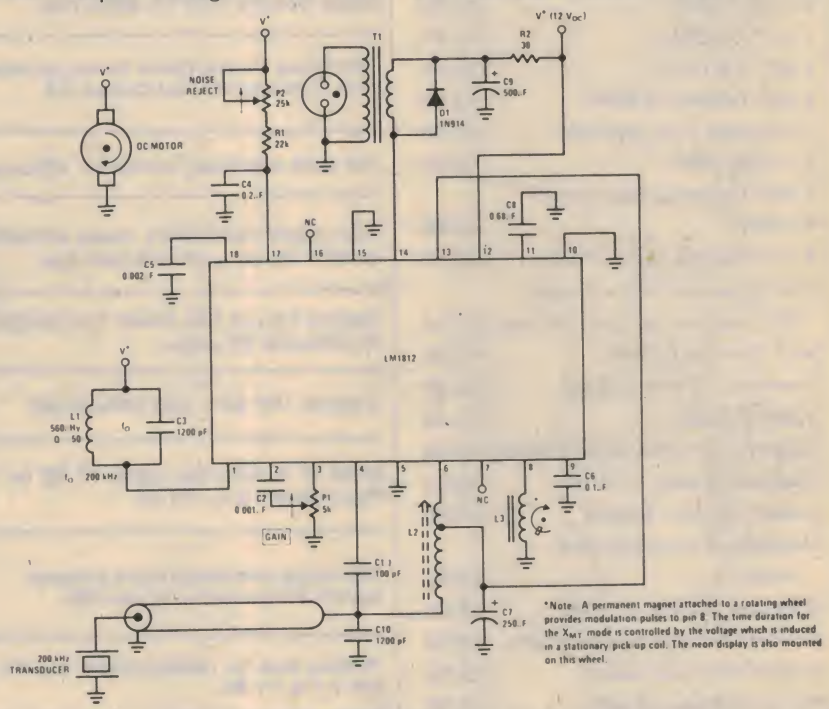
Further information would be available on these National devices from NS Electronics Pty. Ltd., Cnr. Stud Rd. and Mountain Hwy., Bayswater, Vic.

The third item this month is a pair of rhythm generator chips, designed to produce the rhythm patterns for electronic organs and "side-man" units. Released by SGS-Ates, the chips are designated M252 and M253. The two are very similar, except that the first provides 15 rhythms which are mutually exclusive, while the second provides 12 rhythms which may be combined if desired.

Both chips are basically read-only memories (ROMs), designed to control a set of eight sound generator circuits with the usual labels—bongo, cymbals, maracas, etc. They are available with the usual rhythms: tango, waltz, slow rock, rock pop, swing, etc. They use P-channel silicon gate MOS technology, and operate from a dual +5V/−12V supply. Power dissipation is less than 120mW, and they come in a 16-pin and 24-pin DIL package respectively.

Both chips feature a downbeat output, and may be obtained with custom rhythm patterns if required.

Enquiries should be directed to Warburton Franki Pty. Ltd., agents for SGS-Ates (J.R.).



Use of the National Semiconductor LM1812 chip in a typical sonar range or depth finder application. It provides all active circuitry.

For further data on devices mentioned above, write on company letterhead to the firms or agent quoted. But devices should be obtained or ordered through your usual parts stockist.

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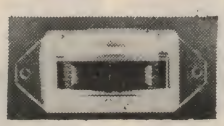

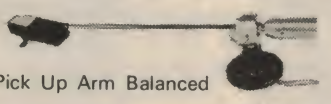

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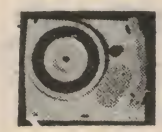

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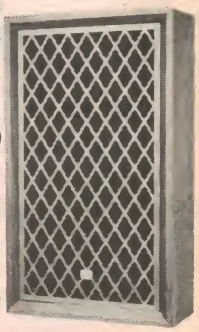

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SYDNEY (CITY): 432 Kent Street, Sydney.
NEWCASTLE: Shops 3-6 West End Arcade, 810 Hunter St., WEST NEWCASTLE 2300. Phone: 69-2103.

● WOLLONGONG, N.S.W. Ph: 84-9034. Hi-Tec Electronics, 265 Princes Highway, CORRIMAL 2518. ● HUNTER VALLEY, N.S.W. Ph: 33-6664. Hunter Valley Electronics, 478 High St., Maitland 2320. ● ADELAIDE: Ph: 255-2249. A. E. Cooling, 6 Trimmer Road, Elizabeth South, 5112. ● MELBOURNE: Ph: 211-4788. Flight Electronics, 1 Derby Road, Caulfield East. 3145. ● BRISBANE: Ph: 97-2509. Delsound, 103 Cavendish Road, Coorparoo 4151. ● NORTH QUEENSLAND: Ph: 78-855. Philtronics, Cnr. Grendon & Palmer Sts, North Mackay, 4740. ● WEST AUSTRALIA: Ph: 41-3427. B.P. Electronics, 192 Stirling Terrace, Albany 6330. ● CANBERRA. Ph: 47-6179. Electronics Shop, 2 Hackett Place, Hackett 2602.

The Amateur Bands

by Pierce Healy, VK2APQ

Novice licence—at last a reality.

During the past decade there has not been a facet of amateur radio in Australia more thoroughly discussed than the novice licence. Its introduction represents a major change in administrative policy and a milestone in the Australian amateur service.

Whether it be the retention of a policy, a considered need, or both, which one promotes, its final acceptance is naturally a cause of some personal satisfaction. The introduction of novice licencing is such an instance.

It has been my opinion, even before introduction of the limited licence (AOLCP) in 1954, that a novice licence should be available in Australia. This view was expressed at WIA federal conventions which I attended, for more than ten years, as NSW federal councillor. The subject has also been highlighted many times in these columns.

As could be expected, there has been criticism and controversy on the wisdom of such a licence. These views were published in "Electronics Australia" and the WIA magazine "Amateur Radio".

There were a number of events, spread over many years, that lead up to the novice licence. These may not be widely known, or maybe, forgotten. As a record, therefore, this may be an opportune time to recall the main ones in chronological order.

In 1952, a policy was adopted at a WIA federal convention supporting negotiations with authorities on a novice type licence. However, such negotiations were not successful.

In 1954, the PMG's Department introduced the AOLCP. This does not require a Morse code test but restricts operation to 50MHz and above. The use of CW is not allowed.

There was some speculation that this was intended to limit the amateur population growth on the HF bands. This may have appeared so, as it was known that there would be attempts to reduce the HF amateur bands at the 1959 ITU Administrative Conference at Geneva.

The use of portions of the HF amateur bands was envisaged by the novice licence proposal.

At the WIA federal convention, Easter 1959, the 1952 policy was amended to set out specific proposals as a basis for negotiation with authorities.

Negotiations with the PMG's Department were unsuccessful and the policy item was amended at the 1962 and 1965 WIA federal conventions. The main change was lowering the output power limit from 25 watts to 10 watts.

At that stage the proposals were:—

a. Morse code test of 5wpm.
b. Examination in radio theory at a lower standard than that required for AOCP and regulations.
c. Operation on 3.5MHz, 27MHz and 28MHz bands using CW only and crystal control.
d. Power input maximum of 10 watts.
e. AOCP exam to be taken by the end of 12 months and licences not to be renewable except at the discretion of the PMG's Department.

During the 1967 convention, it was stated that federal executive (WIA) had approached the PMG's Department twice and twice the submissions had failed.

At the 1968 convention, the Victorian delegate moved "That the Institute no longer advocate the issue of novice licences, with reduction in the code standard". This motion was carried by one vote.

In an effort to counter the move, the NSW delegate, VK2APQ, as a motion arising, suggested that the original policy item be amended by adding the words "if and when considered necessary", to the preamble of the policy item referring to any approach to the authorities. This motion was carried by three votes. However at the 1969 convention it was learned that no action had been undertaken, in the belief that there was no current WIA novice licensing policy following the 1968 motion and conflict between it and the motion arising.

At the 1970 convention two motions were debated at length and, on the casting vote of the chairman, it was determined that the WIA did not advocate novice licences. The NSW delegate commented that the move had done a great disservice to amateur radio. However, a motion arising from the discussion was adopted without dissent. This directed federal executive WIA to co-ordinate information supporting novice licensing, to permit reviewing the policy.

On the basis of that motion a committee was set up in NSW to examine all arguments for and against. Its report, that such a licence would be of considerable benefit to the Australian amateur service, was submitted to the 1971 WIA federal convention.

Although the report was adopted, there were doubts that any action would be forthcoming. As reported in these columns June 1971, a statement was made that there had been "no formal alteration to Institute policy".

A comprehensive resume of the committee's report was given in these notes, July 1971. For some months following, many letters for and against were written by amateurs and interested persons. These were given good coverage in "Electronics Australia" and "Amateur Radio".

Following the intensified interest, the committee continued to review the pros and cons expressed in letters and discussions. A supplementary report was prepared for the 1972 WIA convention. The report, published in these notes for March, 1972, stated that submissions in favour again greatly exceeded those against and therefore recommended action to be taken along the lines set out.

The supplementary report became the basis for discussion at the 1972 WIA convention. The outcome was adoption of a policy seeking a four class licence structure from the PMG's Department.

This policy was submitted to the PMG's Department but was rejected in March, 1973.

However, the Department set out the basis on which it would consider the introduction of a novice licence. (Details were featured in these notes for May, 1973.) It was pointed out that before novice licences could be introduced it would be necessary to amend the Wireless Telegraphy Regulations and obtain the approval of the Minister.

Notwithstanding repeated assurances that the formalities were about to be completed, it was not until April, 1975 that the legislation was promulgated.

The announcement was made in the daily press and subsequently reviewed in the "Electronics Australia", June, 1975 editorial. Also in this section of the same issue.

"Amateur Radio" covered the announcement as a stop press item in the May, 1975 issue.

Then on 23rd June, 1975, the first examination for the (AONCP) Amateur Operators Novice Certificate of Proficiency set down for the next day was cancelled.

The proverb which refers to "—mills grind slowly", is no exaggeration when applied to novice licences. Nearly a quarter of a century—1952 to 1975! Much longer than it took to

—put a man on the moon (first satellite in 1957, first on the moon 1969)
—perfect international television coverage
—design, fabricate and launch seven amateur communication satellites
—reduce the Morse code test requirement for the full amateur licence (AOCP) in Australia from 14 wpm to 10 wpm.

By far the most surprising fact is that the basic technical features of the novice licence are the same as those proposed at least ten years ago. But the scope allowed is much more liberal than ever thought possible, plus no age limit.

It must be truthfully admitted that the PMG's Department is not completely to blame for the extended delay. Personalities and hindrance within amateur circles certainly added very considerably to the time taken.

It is regretted that space has not allowed a fuller coverage of some aspects. These can be read in the proceedings of WIA conventions and these notes which have been referred to.

Those who obtain a novice licence, no doubt owe some thanks to the editors of "Electronics Australia" for supporting the principle. Likewise the WIA is grateful for the publicity given the amateur movement.

The WIA now has the opportunity to vigorously encourage novice licensees to join the Institute and take an active part in its growth. Also, to give positive assistance to novice licence holders, if they so desire, to gain the higher licence status.

Personally, it is gratifying to have been closely associated with promoting the novice licence. We look forward to welcoming, on the air, many who gain this licence.

The final remaining question relating to this narrative is—

How long will it take, after the examination day, for the first novice licence to be issued?

LOCAL & OVERSEAS NEWS

DARWIN APPEAL

The appeal for donations by the WIA to assist amateurs in Darwin to restore equipment lost or damaged by cyclone Tracy closes on 1st September, 1975.

Those wishing to contribute should send donations to—Darwin Relief Fund, WIA, PO Box 150, Toorak, Vic. 3142.

CLUB DIRECTORY

An invitation is extended to radio clubs to supply club details for inclusion in the Radio Club Directory in the December, 1975, issue of these notes.

Only these details received between now and 16th October, 1975, will be included.

Please give details in the following format:—

Name .....
Club call sign:— .....
Meeting place:— .....
Day and time:— .....
Affiliation:— .....
Net frequency:— .....
Contact:— .....

Over the past years this facility has been a means of publicising your club and assisting visitors and prospective members in your area.

Do not delay—Write now.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR BANDS

REMEMBRANCE DAY CONTEST

The annual Remembrance Day contest is conducted by the WIA to perpetuate the memory of amateurs who paid the supreme sacrifice during World War II. It will be held this year on the weekend 15th and 16th August, 1975. All amateurs in Australia and New Zealand may participate.

Unfortunately, the rules for this year's contest had not come to hand when these notes went to press. However, it is not expected that there will be any major changes.

It was reported that the rules would appear in the July issue of the WIA journal "Amateur Radio", available to members only. We suggest that details be sought from that source.

NOVICE LICENCE

With the advent of novice licencing, many enthusiasts are anxious to know what standard they must achieve to pass the examination, particularly the technical paper. Here is a set of sample questions, issued by the PMG's Department. As indicated in the instructions, the actual paper will call for 50 questions to be answered in 60 minutes. (We understand there will be a choice of questions offered.)

While no one would complain that the questions are unduly hard, the candidate will have to know his subject, otherwise some of the questions could still be tricky. If you feel that you can answer questions at this level, you only need to pass the Morse Code and regulation sections in order to obtain a licence.

NOVICE AMATEUR OPERATOR'S CERTIFICATE OF PROFICIENCY
SAMPLE QUESTIONS FOR THEORY EXAMINATION

Only one of the answers given is deemed correct. The question paper must be handed back to the Examination Officer upon completion of the examination. 50 questions to be attempted in 60 minutes.

1. Which of the following microphones requires a source of direct current in order to operate efficiently:—
(a) crystal (b) dynamic (c) velocity (ribbon) (d) carbon?

2. One of the electrodes of the triode valve usually operates at a potential which could result in severe electric shock to a person who accidentally made a contact between it and earth. This electrode is:—
(a) heater (b) cathode (c) grid (d) anode.

3. Indicate which of the following frequencies falls within the VHF (very high frequency) amateur bands:—
(a) 3.53MHz (b) 27.12MHz (c) 146.10MHz (d) 432.00MHz.

4. An amateur station operating on a frequency of 21.125 megahertz could also be referred to as operating on:—
(a) 21,125,000 Hertz (b) 21,125,000 kilohertz (c) 21,125 gigahertz (d) 21,125 cycles per second.

5. A half wave dipole antenna is always:—
(a) supported on two wooden poles (b) fed by a single wire feed line (c) fed at the centre by a two wire feed line (d) fed at each end by a two wire feed line.

6. Which of the following materials would you consider the best conductor of electricity:—
(a) carbon (b) bakelite (c) silver (d) silicon?

7. When it is required to reduce the mains voltage from 240 volts to 12 volts with a minimum loss, use is usually made of a:—
(a) power transformer (b) frequency divider (c) current limiting circuit (d) power amplifier.

8. Radiation of harmonics of the operating frequency of an amateur station is undesirable because they may cause:—
(a) overloading to occur in the antenna coupling circuits (b) harmful interference to other receiving stations (c) severe distortion to the modulation on the operating frequency (d) the operating frequency to vary considerably during modulation.

9. When connected to a direct current reading meter, which of the following components will enable the meter to indicate alternating current:—
(a) a resistor in series (b) a capacitor in parallel (c) a diode in series (d) a thermistor in parallel?

10. Propagation of high frequency radio waves is possible between Australia and Europe due to the presence of the:—
(a) troposphere (b) atmosphere (c) stratosphere (d) ionosphere.

The Morse receiving test will be of five minutes' duration at five words per minute. A maximum of 10 errors is permitted. The sample test is as follows:

The houseboat had a 36 gallon tank which supplied fuel for the outboard engine That was sufficient for 20 hours' use at normal speeds in fact it ran

The sending test will be of 2½ minutes' duration, at five words per minute. A maximum of 4 errors will be permitted. The sample test is as follows:

Power was obtained from a 12 volt heavy duty battery which was charged for

The regulations paper contains four questions, only three of which should be answered. All questions carry equal marks.

RADIO CLUB NEWS

AUSTRALIAN CAPITAL TERRITORY DIV. WIA: AOCP classes are held every Tuesday evening at the Woden High School, commencing at 6.30 pm. Thirty minutes of Morse practice is followed by two hours of theory instruction. Course coordinator, Steve Grimsley, VK1VK

For details write to WIA, ACT Division, P.O. Box 1173 Canberra City 2601.

GEELONG AMATEUR RADIO & TV CLUB: Morse classes are held each Friday night, at 7.45 pm in the club rooms Storrer Street, East Geelong. Theory study classes are also held. Both activities are recommended to those wishing to gain their novice licence.

The club will hold their annual dinner at the Waurn Ponds Hotel, Princess Highway, Waurn Ponds, in August. For details contact the secretary, PO Box 520, Geelong 3220, Vic.

CAIRNS AMATEUR RADIO CLUB: Early in the morning of the 25th May, 1975, fourteen members of the CARC headed from Cairns to Green Island, about 29 km east of Cairns for their first field day. Both HF and VHF equipment was set up and the station was on the air by 9.30 am.

The station operated for five hours and made 168 contacts. These included all Australian States, Borneo, Japan, Niugini (P29), Venezuela, San Salvador, India, Canada, New Zealand, Seychelles and California, Oregon Texas and New Mexico in the U.S.

A two metre contact was made with Townsville about 246 km away. Contacts were also made on two metres on the trip to Green Island. A novel contact was made on that band with a member enjoying the coral beauties of the underwater observatory.

The club has had a special QSL card printed to mark the field day and these are on the way through the bureau.

Any amateur heading north and wishing to contact the club can do so by calling on VHF channel 50. Someone is bound to make you welcome.

CENTRAL COAST AMATEUR RADIO CLUB: In addition to its technical activities the CCARC organises family social trips. The next trip will be on 26th October, 1975 to Katoomba. A tour of Katoomba will take in a visit to the Skyway and the Revolving Restaurant.

Plans are being made to participate in the Scout Jamboree-on-the-Air on the 18th/19th October, 1975. The club station, VK2AFY will be on the air from the club rooms.

The CCARC "News Sheet", editored by Ed Dyring, VK2BED, keeps members up to date with local happenings and reports on meetings. The club meets at their rooms, Dandaloo Street, Kariong. Visitors are welcome. Postal address is PO Box 238, Gosford 2250

ST. GEORGE AMATEUR RADIO SOCIETY: Fifty-five members and visitors enjoyed a very lively discussion on various aspects of amateur radio at the meeting held on the 4th June, 1975.

The society has reconstructed its educational activities and invites any interested person to attend classes on Tuesday and Thursday evenings. These classes have been designed to cater for AOCP and novice licence candidates.

For details write to the secretary, PO Box 270, Rockdale, NSW, 2216, or attend a meeting held on the first Wednesday of each month in the Rockdale Civil Defence HQ, western end Highgate Street, Bexley, NSW.

SCARS office bearers for 1975/76 are: President—Bill Shakespere, VK2AGF; Vice-President—Chris Jones, VK2ZDD; Secretary—Jim Lupton; Treasurer—George Hodgson, VK2QH; Committeeman—Erik Piip, VK2BQP; Publicity Officer—Noel Spratt, VK2BSN; Dragnet Editor—Nev Shaw, VK2FJ.

DX GROUP: This new club has been formed in Sydney. Its aim is to foster the art of long distance radio listening and amateur radio communication.

Meetings are held monthly at the WI Centre, 14 Atchison Street, Crows Nest, on the first Friday of each month at 7.30 p.m.

The club is extremely active and has already manned a stand at the Centrepoint Hobbies Exhibition during the school holidays in May, 1975, and held a field day trip to the Wattagan Mountains. Many interesting activities are planned. These include contests and awards.

For full information write to the publicity officer, Roger Browne, 18A Bradleys Head Road, Mosman, NSW, 2088, or telephone the president, Neil Stollznow (Sydney) 44 6030.

GOLD COAST RADIO CLUB: A number of visitors from areas as far south as Canberra attended the May general meeting in the Currumbin CWA Hall. At the meeting Tony Richardson, VK2YCR, was presented with the Gold Coast Award.

Barry Flood, of the Queensland Aviation Historical Society, gave an interesting talk on the restoration and preservation of old aircraft. The talk was illustrated with many pictures including those of moving a Canberra bomber from Amberley to the museum site at Kuraby.

The club station, VK4WIG is on the air as control for HF and VHF nets every Sunday evening. The two metre net starts at 7.30 p.m. on the channel 1 repeater and the 80 metre net (3650kHz) at 8.00 p.m.

All interested persons are welcome to join the nets.

Postal address of the GCARC is PO Box 588, Southport, 4215, Qld.

MAITLAND RADIO CLUB: The youngest MRC member to receive his AOLCP licence is 16 year-old Ian Lawrence, a Maitland High School student. He has been issued with the callsign VK2YDO. However, after making application for the limited licence, Ian sat for the Morse test for the full licence and is confident he was successful. Arrangements are being made for the presentation of prizes for the winning entries at the 1975 Maitland Show.

The presentations will be made in the club's theatrette where a new amplifier donated by Dr. R. H. K. McKerihan and Mrs. McKerihan has recently been installed. The amplifier is used with the up-dated speaker system in the auditorium.

The MRC is located in Maize Street, Tenambit, East Maitland. Visitors are welcome.

BLUE MOUNTAINS BRANCH WIA: Members made available a wide range of equipment for operating and static exhibits for the first amateur radio demonstration held in the Blue Mountains.

The demonstration was on Saturday, 17th May, 1975, at the Springwood Scout Hall. Placards in the shopping centre and invitations placed under car windscreen wipers attracted a number of visitors. Many young people showed particular interest and it is possible that the branch membership will be increased.

The Blue Mountains Field Day will be held on Sunday, 23rd November, 1975. The venue is the North Springwood Community Hall in Hawkesbury Road, which runs from Springwood to Hawkesbury Lookout and Richmond. More details later. Make a note of the date for a family outing.

WESTLAKES RADIO CLUB: The NSW State Minister for Youth, Ethnic and Community Affairs, Mr. S. Mauger, has made available a grant of $400 to the WRC. Mr. James, MHR, member for Hunter, Mr. Morris, MHR, member for Shortland and Mr. Hunter, MLA, member for Lake Macquarie, were instrumental in obtaining the financial grant for the club.

The grant will be used to complete the sewerage facilities at the club premises.

At the end of the first half of 1975 the WRC membership was 136, an increase on the 1974 total. The club policy allows prospective members to attend and participate in activities before deciding if they wish to become a member.

Morse classes are conducted at the club every Wednesday evening. The instructors are Joe Waugh, VK21Q and Wal Lean, VK2BZK. Another class is conducted on Saturday afternoon by Keith Howard, VK2AKX. This is oriented towards the novice licence.

It is possible that two separate class levels will be conducted at the club; one to cover the novice licence and the other for the full YRCS certificate course.

Visitors are always welcome to the club, located at York Street, Teralba.

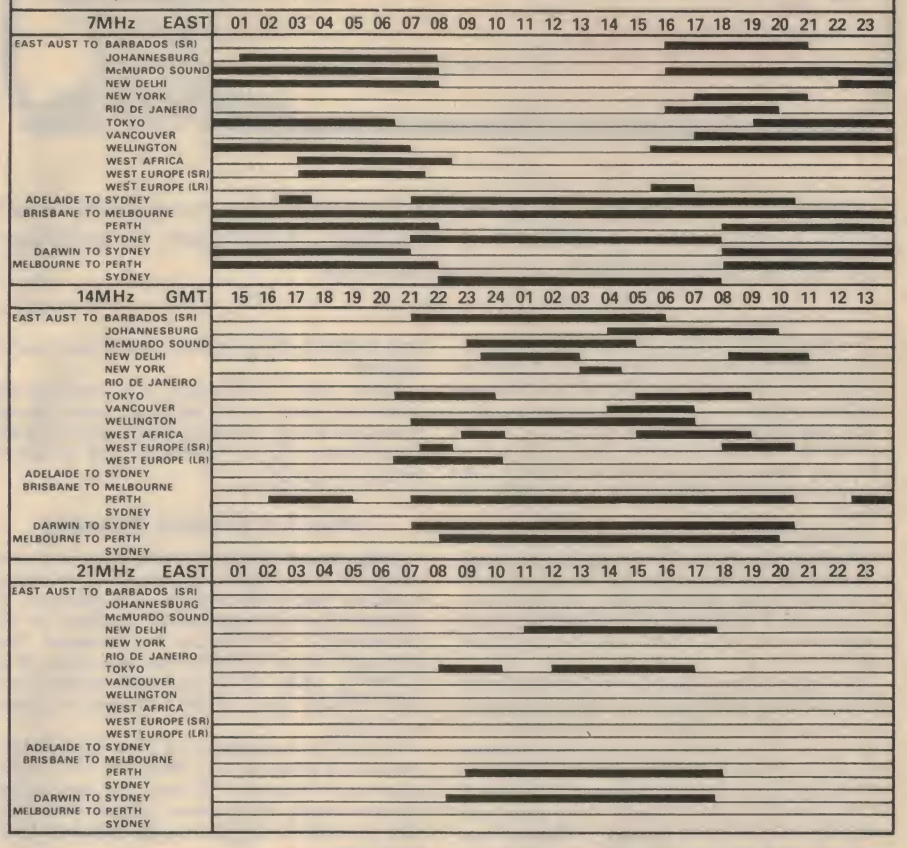
ILLAWARRA BRANCH NSW DIV. WIA: Fifty hours of concentrated effort went into constructing the new one kilowatt power amplifier which has been installed in the moonbounce transmitter chassis.

Lyle Patison, VK2ALU, reports that a letter has been received from F9FT who wants to arrange special EME tests.

The weekly schedules on 14MHz with ZE5JJ continue to provide a useful interchange of EME information. It is also interesting to note that the cover of the new ARRL publication—Specialised Communication Techniques for the Radio Amateur—carries a photograph of the Dapto moonbounce installation.

IONOSPHERIC PREDICTIONS FOR AUGUST

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 8.75



Shortwave Scene

by Arthur Cushen, MBE

Expansion of the gospel programs of Family Radio, a relatively newcomer to shortwave broadcasting, has been announced. In addition, new transmitting facilities are being installed.

The Family Radio station WYFR has been on shortwave for only two years, but the history of the station goes back to 1936. Since then it has had four callsigns and three owners.

The original station in Boston was W1XAL, which opened in 1936, and for many years operated as University Radio, giving educational programs on shortwave. In 1941 the callsign was changed to WRUL.

Later the studios were moved to New York, and still later, it became part of a new organisation, Radio New York World Wide, using the callsign WNYW. Transmitters remained at Suituate, Massachusetts, consisting of 3 100kW transmitters and two 50kW transmitters, with the WYFR studios in Oakland, California.

The ministry of Family Radio went on the air in 1959 in San Francisco, California. Since then, six powerful stations have been purchased and committed to 24 hours a day. These stations broadcast to such major metropolitan areas of the United States as New York, Philadelphia, San Francisco and the nation's capital, Washington DC. In 1973 Family Radio purchased transmitters and antennas located in Suituate, Massachusetts. Programs for shortwave are prepared at Family Radio's main studios in Oakland, California.

WYFR broadcasts in English, Spanish, Russian, Arabic, German and French. Several transmissions in English can be heard, but the best reception is for the period 2100-2245 GMT on 17755, 15150, 15135, 17845 and 15110kHz.

RADIO VERITAS TESTING

After some months of inactivity Radio Veritas has been heard testing on 9570kHz from around 1015GMT to after 1200GMT. According to station announcements they are also using 11910kHz for this transmission beamed to Indonesia and East Malaysia. The station announcements are given in Indonesian and English and indicate that these tests are in preparation for a regular service to East Asia in a few months time. Music is generally broadcast, interrupted at irregular intervals for the recorded announcement. Reports from listeners are requested to the new address, Radio Veritas Overseas, PO Box 18-373, Quezon City, Philippines.

INDONESIAN SIGNALS

A new frequency for Jakarta is 7190kHz, and broadcasts on this channel have been heard from 0955GMT. At this time the interval signal is observed, with program transmission commencing at 1000 GMT. After full announcement and information in Indonesian, a jazz program has been observed. There is some side-band interference from Radio Japan on 7195kHz also opening at 1000 GMT.

According to Robert Yeo of Melbourne, RRI Jakarta on 7190kHz was heard from 0750GMT till closing at 0800GMT, and again from 1000GMT till after 1300GMT. This frequency was formerly used by Jayapura.

David Foster of Melbourne has identified the Indonesian station on 3116kHz as Radio Daerah Kabupaten Serang, which was listed incorrectly in the World Radio and TV Handbook 1975 as RPDK, Serang, on 3121kHz.

JAPAN'S REGIONAL SERVICES

Radio Japan in Tokyo has made some frequency changes. For its regional service to the Americas, broadcast from 0100-0300GMT, the frequency of 15235kHz has been replaced by 15420kHz. In the transmissions to Europe, the first broadcast from 0630-0830GMT on 15390kHz has been replaced by 15430kHz, while the second transmission from 1800-1930GMT finds 9700kHz dropped in favour of 9605kHz.

The service to Australia and New Zealand continues to be broadcast from 0930-1030 GMT, and is heard on 11875 and 15235kHz. On Sunday the program includes a DX session, heard at 1010 GMT, with information supplied by the Japanese Short Wave Club.

VOA CHANGES

The Voice of America has made two frequency changes for the period up to September 7, 1975, for its service to Oceania from 2200-2400GMT. The transmissions re-broadcast from Dixon are now on 17820 and 15205kHz, the latter frequency replacing 21610kHz. Transmissions from the Philippines are on 15290kHz, and on 9545kHz which replaces 11760kHz. The broadcast for evening reception from 1100GMT remains on 5955 and 9730kHz from Dixon and on 6110kHz from the Philippines.

PAKISTAN NEW FREQUENCIES

Radio Pakistan has been observed on some new frequencies in its external broadcast, and one of these, 15205kHz, is giving good reception from 2345GMT.

This transmission is in Urdu for one hour, except for the period from 0000-0010GMT, when English news and commentary is broadcast. There is some interference up to 2400GMT from VOA Dixon, which is also using 15205kHz.

Two out of band frequencies have been noted closing at 1900GMT after a program in Persian. These frequencies are 5020 and 4020kHz, which are on the air from 1615-1900GMT to Afghanistan and Persia.

RADIO NEW ZEALAND

The External Service Division of Radio New Zealand, which is broadcasting on shortwave, has the new mailing address of PO Box 2092, Wellington. The studios are now located at Aurora House, The Terrace, Wellington.

The present schedule of Radio New Zealand to the Pacific is: 1700-1945GMT on 6080, 9755kHz; 2000-0545GMT on 15110kHz; and 0600-0845GMT on 6080, 9540kHz. For Australia, the schedule is 2000-2400GMT on 11900kHz; 2400-0545GMT on 15280kHz; and 0900-1145GMT on 6080, 9520kHz. The schedule to Antarctica is on Sundays from 0015-0045GMT on 15280kHz.

Arthur Cushen's DX World is now broadcast on the first Wednesday of each month at 0645GMT and repeated at 1030GMT. This broadcast is again repeated the following Saturday at 2315GMT. It is also carried on the Radio New Zealand National Network on medium-wave on the second Thursday of each month at 1230GMT, when it is broadcast by 22 stations.

BELIZE SIGNALS RECEIVED

Many New Zealand listeners have heard Radio Belize on 3300kHz during the winter season. Reception has been possible up to signoff at 0510GMT, when the national anthem has been played. Belize is the former British Honduras, has world news at 0500GMT, followed by an epilogue before the close down announcement.

The station has confirmed reception in 20 days according to a report in the New Zealand DX times.

MEDIUM-WAVE NEWS

AUSTRALIA: The new ABC Access Radio 3ZZ in Melbourne has been widely reported on 1220kHz. The power used is 2kW and operation is from 0800-1300 GMT daily. From Monday to Thursday most of the programs broadcast are in foreign languages, with the rest of the week reserved for English. According to Ilmars Rutenfelds, Heidelberg, Victoria, the station is keen to receive reception reports. These should be addressed to: Access Radio 3ZZ, PO Box 1686, GPO, Melbourne, Victoria, 3001, Australia.

Due to the operation of 3ZZ on 1220kHz, 4AK Oakey, Queensland, which used this frequency for many years has moved to 1240kHz to avoid interference. On this channel they suffer interference from 3TR Sale Victoria. 4AK operates 24 hours a day, and can be heard clearly when 3TR is silent.

Two further stations have commenced operation and these are 2EA in Sydney on 800kHz and 3EA in Melbourne on 1120kHz. The stations are operated by the Australian Community Relations Office and use low power as they are intended for reception only in factories and homes in the immediate vicinity. The first transmissions were restricted to two hours in the morning, and to lunch and evening sessions.

BANGLADESH: According to the Indian DX Club International, Radio Dacca is testing with 1000kW on 690kHz. The program of Dacca A, formerly on this frequency, is now carried on 830kHz.

LISTENING BRIEFS

EUROPE

AUSTRIA: Vienna's transmission to North America is being well received on 5980kHz from 0400-0600GMT, with English broadcasts noted at 0430GMT. This transmission was previously carried on 7195kHz.

SWEDEN: Stockholm is carrying a relay of the Home Service on 6100kHz, and the same program is carried on the old frequency of 6065kHz with both signals being received at 0430GMT. The transmission on 6100kHz is on the air from 0330-0500GMT Monday-Friday and from 0330-0630GMT Saturday and Sunday.

GREECE: The BBC Monitoring Service reports that Radio Athens has reverted to the use of 1534kHz for its external service broadcast in Greek to Australia from 0800-0950GMT, and for its Balkan Service in Albanian, Serbo-Croat, Romanian and Bulgarian (15 minutes each) from 1600-1700GMT.

AFRICA

SOUTH AFRICA: Two signals carrying the Home Service of the South African Broadcasting Corporation have been heard at 0500GMT. According to Dene Lynberg, reporting in the New Zealand DX Times, English news is heard on 4835kHz, while news in Afrikaans is broadcast at the same time on 4875kHz. A transmission on 5980kHz from Radio South Africa is heard at 1700GMT, with a broadcast in "Chichewa" presented following the time signal.

LIBYA: Tripoli has been heard on 11755kHz with a news bulletin in Arabic at 0015GMT. John Mainland in Wellington reports reception of this signal, which was observed from as early as 2350GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WEST, 10 hours for EAST and 12 hours for NZT.

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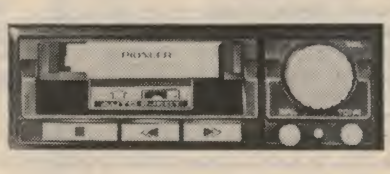

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INFORMATION CENTRE

HUM and HISS FILTER: Could I eliminate hum and hiss from tape recordings which makes my lecturer difficult to understand at times? Could I use some sort of capacitive or resistive filter in the microphone lead to a tape recorder? If so, could you give me an idea of a circuit to use, to experiment with? (C.R., Rockhampton, Qld.)

It would probably be easier and more appropriate to use a hum and hiss filter circuit during replay rather than during recording.

You may care to experiment with the "Philips dynamic noise limiter" circuit which we published in January 1972 (File 8/AT/35) or the Low and High filters featured in the January 1974 article on the Playmaster 140 (File 1/SA/44).

PLAYMASTER 132: On the subject of Playmaster 132 power amplifiers. Having built four of these amps at different times I must commend you on your design, once the bugs are eliminated. The reason for this letter is the question of power. How, with a 60 volt rail can you come up with 45 watts? Maybe the problem of "Universal laws" again. Using two entirely different approaches, I came up with the same answer, 35.9 watts. If there is any mistake in my theory or working could you please inform me. (R.Y., MacGregor, Qld).

As you can see, R.Y., we have not reproduced your calculations, but they do contain errors. The power we claim was measured, not calculated. However, the result can be checked as follows: At a power of about 45 watts into 8 ohms, voltages losses across the output transistors and emitter resistors amount to about 6 volts peak. Subtracted from the 60 volt rail, this leaves 54 volts peak-to-peak delivered to the load. Divide this by 2.83 to give the rms voltage across the load—19 volts. Square this and divide by the load impedance (8 ohms) to get 45 watts.

HISTORICAL FEATURES: Being one of your junior readers (14 years) I found your magazine most useful and enjoy reading the various articles, especially "The Serviceman". Could you please answer the following queries for me through the magazine.

Perhaps you could start a small monthly feature entitled "Going back 40 years" in which you would describe an early issue of your magazine printed 40 years ago. In the article you could perhaps show a small reprint of the cover for the month concerned and review the projects for that month. (Of course there is a lot more scope than just this!)

Can you please tell me back to what date you can supply project reprints? Is it possible to obtain two reprints from one issue for 80c?

In future projects in your magazine perhaps you could describe a radio and test gear using valves for a change, as I am sure there are a lot of readers like myself with old valves salvaged from old chassis etc.

Do you have metalwork blueprints for the 1953 "Little Jim"? I have built the ZN414 IC radio as in your May 1974 issue. However, selectivity is very poor and the set overloads strongly on local stations (1 mile away). Have you any ideas as to why this happens?

Thank you very much for your help, keep up the good work! (B.M., Henderson, New Zealand.)

We think that your idea of a historical feature is quite a good one, and if enough interest is expressed by other readers, we will certainly consider starting such a series.

We can supply reprints of articles for all issues back to and including the April 1939 issue, which was the first edition of "Radio and Hobbies". These cost $2.00 each, so that two reprints from the one issue would cost $4.00. However, if a back copy is available, this is usually much cheaper. The exact costs are explained in the box on these pages.

Although we have never described test gear built from scavenged parts, we have presented several radios in this form. The ABC Three, in February 1966 (File No. 5/ACR3/25); the ABC Four in March 1966 (File No. 5/ACR4/44) and the ABC Five in August 1966 (File No. 5/ACR5/47) were such designs. The Basic Mono Amplifier presented in May 1967 (File No. 1/MA/47) is based on surplus parts, and should be suitable.

Metalwork dyelines are available for the 1953 "Little Jim".

As stated in the May article, the ZN414 IC receiver will be swamped by a strong signal. This will result in poor selectivity, and possible high distortion levels. A simple cure is to rotate the receiver till the offending station is nulled out.

We hope that we have cleared up all your queries, and that you continue to learn from the magazine.

SUPER SUPERFET! I am a fan of your magazine and being a novice at electronics I enjoyed reading Elementary Electronics. I built the "Superfet" just before I went on holidays to Tweed Heads, and it gave good performance on all the local stations. I decided to try DX. I set the receiver just in oscillation and scanned the HF end of the band. There were dozens of stations there which I found I could demodulate. I found one station playing good music and listened to it for a callsign. It was 2SM, Sydney. I think this is not bad going for a two transistor set—the signal coming well over 900 km.

The same station was barely audible on a transistor radio with the volume control fully advanced. Thanks for a great circuit. Will there be more Elementary Electronics? (N.W., Virginia, Qld.)

We agree, N.W. It is good going for a small radio like the Superfet. Congratulations. As you have probably seen, Elementary Electronics appears whenever we can fit it into the magazine.

CIRCUIT WANTED: I have a W.Y.A. Multitester (Aust.) No. 1 Mk. 1 I wonder whether you or any of your readers could help me with a circuit diagram, instruction manual, or other information, or where such information may be obtained.

It appears that information on circuits for TV antenna amplifiers, marine band and aircraft VHF receivers (not converters) appears to be very scarce. Would it be possible to feature articles on these subjects in future issues? (Mr. H. N. Babbington, 4 Biara Avenue, Campsie, 2194.)

We cannot help directly regarding the manual but, as you can see, we have published your full name and address in case any readers can help. We have no plans at present to describe the various projects you describe, although the rapid development of ICs and similar devices may make some of them a more attractive proposition in the future.

HARD-TO-GET PARTS: My compliments on an excellent magazine. Having had trouble in obtaining the R53 thermistor, I feel that other readers may have had the same problem. They may be interested to know that STC have replaced the R53 with the RA53 which should be available shortly.

Have you ever described a valve tester similar to those seen in shops which give a "good/bad" indication? What do these instruments really test, and how does one test for "gas"?

I have had trouble finding the ICs used in the Octave Note Synthesiser of May 1974. Can you help me? (C.M., Ivanhoe, Vic.)

Thank you for the advice regarding the thermistor. We are following this up and may publish a note if this appears appropriate. The valve testers would almost certainly be "emission testers". This subject was covered in full in the December 1960 and January 1961 issues, in which was described the design philosophy and construction of a practical valve tester. (File Nos. 7/VT/2-3.) Reprints are available for $2.00 each ($4.00 total).

The SN74176 and 74196 ICs are available from Warburton Franki (Sydney) Pty. Ltd., P.O. Box 394, Auburn, N.S.W., 2144.

BENDING THE RULES: With reference to the Long Period TTL Monostable published in the "Circuit and Design Ideas" section of the December issue, it would be greatly appreciated if you could provide additional details on the pin connections for the 7413 IC. Could you also explain the term "½-7413", and the meaning of the letters "ST" in the square box. (P.S., Ulverstone, Tas.)

Strictly speaking, this request is outside the scope of our Information Service. It must be emphasised that the designs presented in "Circuit and Design Ideas", with few exceptions, have not been built or tested in our laboratory, but are simply reprinted from other technical literature. As such, this section is intended only as an ideas section for those constructors with sufficient experience to expand on the necessarily brief details provided. Therefore, we cannot normally undertake to provide information additional to that published, nor can we undertake to aid those encountering constructional difficulties.

Having said all that, we will make an exception in your case P.S. However, any future requests for information along these lines from yourself or other readers will have to be rejected. The information required by you is as follows: pins 1, 2, 4 & 5 are the four NAND gate inputs, three of which are paralelled and connected in series with the 1k resistor, while the fourth is connected to the emitter of the BC109 transistor; pin 6 is the output; and pins 7 & 14 are connected to ground and Vcc (5V) respectively. No connections are made to the remaining pins. The term "½-7413" simply refers to the fact that only one of the two identical Schmitt trigger circuits in the 7413

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

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BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing for 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia" Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

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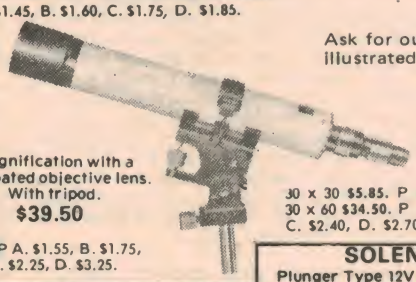

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SORRY NO C.O.D.

package is used in the circuit. The letters "ST" are an abbreviation for Schmitt trigger.

QUESTIONS, QUESTIONS: Congratulations on a first class magazine. Having built the TRF receiver in the May 1974 issue, how do you improve the selectivity? Can this be done using a double tuned circuit arrangement as used in the crystal set published in the November 1973 issue?

Have you ever published a design for a small stereo amplifier using few parts and having an output of around 3W continuous that is simpler and cheaper than the Playmaster 142? How do you measure speaker impedance with a multimeter? Finally, from where can you obtain tagboard? (D.C., Roseville, N.S.W.)

Although we have not tried it, your idea of using a double tuned circuit arrangement with the May 1974 TRF receiver is an interesting one, and you may care to experiment along these lines. Note also that some suggestions for improving selectivity were presented in the text of the original article.

At this stage, we don't really have a design which would meet your requirements for a low cost stereo amplifier.

As a general rule of thumb, the DC resistance of a speaker voice coil is approximately 2/3 its normal impedance. Tagboard should be available through your usual parts supplier.

MUSICOLOUR II: I have recently built a Musicolour II unit from a kit. The circuit suppled is a direct reprint from "Electronics Australia" for December 1971 (File 2/PC/15).

The unit performs OK but I would like to increase the sensitivity as I find that when connected to the 8-ohm loudspeaker terminals of my amplifier and with the sensitivity control of the Musicolour at maximum I still cannot get complete control of the light output. The lights tend to remain full on when the colours are turned up to the level desired. Could you give me any information about making the Musicolour more sensitive? (M.K., Mile End, SA.)

If you can turn up the controls on the Musicolour to the point where the lights tend to remain on when you are listening at normal level, then there is no need to increase the sensitivity. Any increase in sensitivity would merely increase the tendency of the lights to remain full on. You will find that you have to carefully juggle the settings on the Sensitivity, Low, Medium and High controls to get the best display with a particular program.

Perhaps you may be expecting too much of the Musicolour performance. Other readers have expressed the opinion that the light display is not progressive enough, ie, that the lights are either on or off with a rapid transition between the two states. If so, you may care to use a compressor circuit in the Musicolour such as that published in February 1970. (File 1/M/13).

FILTER UNIT: I would like to see published soon a filter unit (scratch and rumble) suitable for home construction. Many filters you can build now seem to either reduce the volume by about fifty percent or remove the bass output. I am sure a lot of other readers would agree that this would be a most worthwhile project. It could be described separately or as a combination filter.

Congratulations on a fine magazine, the quality is excellent. (S.G., Geelong, Vic.)

Thank you for your comments about the magazine. We presume that the type of filters you have in mind are of the sharp cut-off variey. While such filters can produce a worthwhile improvement in certain types of noisy signals, it should be realised that any noise signals occupying the same frequency bands as the wanted signal cannot be removed by filters without at the same time removing the wanted signal.

We are not keen on the term "scratch filter", as it implies that it is possible to filter out "scratch" from records. The reasons for this are explained quite clearly in an article titled "Scratch Filters: A Myth that Lingers On", which appeared in the September 1969 Issue.

Sharp cut-off rumble filters can serve a useful purpose in eliminating some annoying turntable sounds. To date we have not described such a filter, however.

AMPLIFIER PROBLEM: A few months ago I constructed the Playmaster 136. Its performance is fine except for one problem which worries me: when first switched on, there follows after an interval of approximately ½ second a thud-like sound from the loudspeakers. I suspect that the cause is that somehow I have not evenly matched the resistance of the two pre-set pots in the power amplifiers. If this problem cannot be eliminated, is it likely to be something to worry about? (D.B., Burwood, NSW.)

We have abbreviated your letter somewhat D.B., but retained its essential points, It is fairly normal for a "thud" to emanate from the loudspeakers when an amplifier is switched on. This effect is caused by switch-on transients either in the power amplifiers or in the preamplifier, or a combination of both. Some amplifiers do, however, incorporate special circuitry to eliminate this effect (eg. a relay which leaves the speakers disconnected for a specific time period after switch-on). Provided the "thud" is at a respectable level, there is nothing to worry about. Note, however, that if the switch-on transient is particularly objectionable, and if sensitive loudspeakers are being used, speaker damage could result.

TRANSISTOR-FET TESTER: The article in the August 1971 issue describing a simple tester for bipolar transistors and FETs (also in the Project Book) does not specifically refer to JFETs, but I assume that these are the FETs which the tester will check. Presumably you can't check MOSFETs—which are now coming into increasing use. A modification to check these devices would be very welcome. Have you anything in mind? (L.S.J., Christchurch, NZ.)

There's no reason why you can't check depletion-mode MOSFETs with the tester, L.S.J., providing that you take the necessary precautions when handling devices without protective diodes. For these devices we suggest that you keep the leads all shorted together, with a piece of narrow-gauge tinned copper wire wrapped around them a few times, and unwind the wire only after the device leads are connected into the tester circuit.

As it stands the tester is not really suitable for dual-gate devices, or for enhancement-mode devices. We'll certainly look at the idea of a modified design to allow testing these also.

Notes & Errata

RIAA PREAMPLIFIER FOR MAGNETIC CARTRIDGES, November 1973, File No. 1/PRE/29: The capacitor in series with the 560 ohm resistor should be 10uF, and not 100uF as shown in the circuit, wiring diagram and parts list. This error also occurred in the Projects and Circuits Handbook.

Primo mikes . . . from p. 19

windscreen fitted it also gave excellent voice reproduction, and was very tolerant of overload.

In short, the EMU-522 would appear to be a very high quality unit, and well suited for serious music and drama work. It is a tribute to modern microphone technology that a microphone of this calibre can be made available at the price level concerned.

Suggested retail price of the DM-1487 is quoted as $29.50, including sales tax, while that of the EMU-522 is quoted as $16.95.

These and other microphones in the Primo range are available via the usual suppliers from the Australian agents for Primo, Paris Radio and Electronics, of 7 Burton Street, Darlinghurst, NSW 2010. (J.R.)

Unique Offer to our readers

This adaptable Light Dimmer turns your lights down low.

Look — it can cost you dollars just to get an electrician in to install a dimmer system. And that's just the cost of a house visit. Now you can save that much by buying this light dimmer. It fits any standard light socket, with no special installation or wiring.

- One discreet dial gives you every variation of light — from bright to dim.
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Mood lighting! Be the first in Australia with the latest thing in lighting.

$9.95
POST FREE
Money back if not delighted.

Fit it into a Standard Lamp over a dining table, for coffee and brandy, turn up the music and turn down the lights!

Fix it into a bedside lamp, bright for reading, low for loving or just to let him know you're still awake.

it's so easy

1. Your lampshade fits the dimmer switch. Then simply insert your light globe.

Fit it into a Table Lamp — bright for working, reading or sewing. Dim for watching TV, or just gentle conversation.

And, what a boon as a night light in the nursery! A perfect answer to the problem baby who won't sleep in the dark.

set the mood you want

2. Your dimmer switch plugs in exactly as a light bulb. Turns to the left to dim.

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Marketplace

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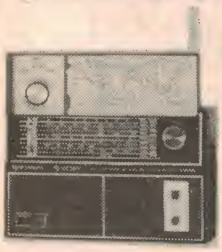

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The key to the Success of SANSUI's New AU. Series Stereo Amplifiers.

As Japan's leading audio-only manufacturer, Sansui has always provided the vanguard in amplifier technology, design and development.

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Output: 35 watts RMS per channel into 8 ohm speaker systems. **THD:** Less than 0.15%. **Frequency response:** 10-35,000 Hz. +0 5, −1 dB. Sensitivity suits magnetic cartridges, tuners, tape decks, etc. **Recommended list price:** $419.

SANSUI — AU-6600.
Output: 45 watts RMS per channel into 8 ohm speaker systems. **THD:** Less than 0.15%. **Frequency response:** 10-40,000 Hz. +0.5, −1 dB. Sensitivity suits magnetic cartridges, tuners, tape decks, etc. **Recommended list price:** $469.

SANSUI — AU-7700.
Output: 55 watts RMS per channel into 8 ohm speaker systems. **THD:** Less than 0.1%. **Frequency response:** 10-50,000 Hz. +0.5, −1 dB. Sensitivity suits magnetic cartridges, tuners, tape decks, etc. **Recommended list price:** $549.

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